

## **SECTION 2**

# **HYDROLOGY CALCULATIONS**

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RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)  
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\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*  
\* W.O. 2118-8, EL TORO MATERIALS \*  
\* 25-YR STUDY \*  
\* PROPOSED CONDITION \*  
\*\*\*\*\*

FILE NAME: ELTORO-P.DAT  
TIME/DATE OF STUDY: 12:53 02/18/2014  
=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:  
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---\*TIME-OF-CONCENTRATION MODEL\*---  
USER SPECIFIED STORM EVENT (YEAR) = 25.00  
SPECIFIED MINIMUM PIPE SIZE (INCH) = 18.00  
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.90  
\*DATA BANK RAINFALL USED\*  
\*ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD\*

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*  
HALF- CROWN TO STREET-CROSSFALL: CURB GUTTER-GEOMETRIES: MANNING  
WIDTH CROSSFALL IN- / OUT- / PARK- HEIGHT WIDTH LIP HIKE FACTOR  
NO. (FT) SIDE / SIDE/ WAY (FT) (FT) (FT) (n) =====  
1 18.0 13.0 0.017/0.017/0.020 0.50 1.50 0.0313 0.125 0.0150  
2 16.0 11.0 0.017/0.017/0.020 0.50 1.50 0.0313 0.125 0.0150  
GLOBAL STREET FLOW-DEPTH CONSTRAINTS:  
1. Relative Flow-Depth = 0.00 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)  
2. (Depth)\*(Velocity) Constraint = 6.0 (FT\*FT/S)  
\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN  
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*  
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*  
FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21  
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<  
=====

ELEVATION DATA: UPSTREAM (FEET) = 792.80 DOWNSTREAM (FEET) = 789.70

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)]\*\*0.20  
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.991  
\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.460  
SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 0.61 0.20 0.400 75 8.99  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA RUNOFF (CFS) = 1.86  
TOTAL AREA (ACRES) = 0.61 PEAK FLOW RATE (CFS) = 1.86

\*\*\*\*\*  
FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 62  
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>>>>>>(STREET TABLE SECTION # 1 USED)<<<<<<  
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UPSTREAM ELEVATION (FEET) = 789.70 DOWNSTREAM ELEVATION (FEET) = 784.60  
STREET LENGTH (FEET) = 422.00 CURB HEIGHT (INCHES) = 6.0  
STREET HALF-WIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00  
INSIDE STREET CROSSFALL (DECIMAL) = 0.017  
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017

SPECIFIED NUMBER OF HALVESTREETS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 3.27  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH (FEET) = 0.33  
HALF-STREET FLOOD WIDTH (FEET) = 11.86  
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.49  
PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.83  
STREET FLOW TRAVEL TIME (MIN.) = 2.83 Tc (MIN.) = 11.82  
\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 2.964  
SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 1.09 0.20 0.400 75  
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA (ACRES) = 1.09 SUBAREA RUNOFF (CFS) = 2.83  
EFFECTIVE AREA (ACRES) = 1.70 AREA-AVERAGED Fp (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
TOTAL AREA (ACRES) = 1.7 PEAK FLOW RATE (CFS) = 4.41

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH (FEET) = 0.36 HALF-STREET FLOOD WIDTH (FEET) = 13.48

FLOW VELOCITY (FEET/SEC.) = 2.65 DEPTH\*VELOCITY (FT\*FT/SEC.) = 0.95  
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 714.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 IS CODE = 81  
\*\*\*\*\*

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<

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MAINLINE Tc (MIN.) = 11.82

\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 2.964

SUBAREA LOSS RATE DATA (AMC II):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN

RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 1.21 0.20 0.400 0.400 75  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA (ACRES) = 1.21 SUBAREA RUNOFF (CFS) = 3.14  
EFFECTIVE AREA (ACRES) = 2.91 AREA-AVERAGED Fp (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
TOTAL AREA (ACRES) = 2.9 PEAK FLOW RATE (CFS) = 7.55

\*\*\*\*\*  
FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 21  
\*\*\*\*\*

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 292.00

ELEVATION DATA: UPSTREAM (FEET) = 792.50 DOWNSTREAM (FEET) = 787.80

Tc = K\*((LENGTH\*\* 3.00)/(ELEVATION CHANGE))\*\*0.20

SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.273

\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.627

SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)

RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 0.62 0.20 0.400 0.400 75 8.27  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA RUNOFF (CFS) = 1.98  
TOTAL AREA (ACRES) = 0.62 PEAK FLOW RATE (CFS) = 1.98

\*\*\*\*\*  
FLOW PROCESS FROM NODE 5.00 TO NODE 9.00 IS CODE = 62  
\*\*\*\*\*

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<

>>>>(STREET TABLE SECTION # 1 USED)<<<<<<

=====

UPSTREAM ELEVATION (FEET) = 787.80 DOWNSTREAM ELEVATION (FEET) = 780.00

STREET LENGTH (FEET) = 518.00 CURB HEIGHT (INCHES) = 6.0

STREET HALFWIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL, GRADEBREAK (FEET) = 13.00

INSIDE STREET CROSSFALL (DECIMAL) = 0.017

OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020

Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150

Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 3.78

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH (FEET) = 0.34  
HALFSTREET FLOW WIDTH (FEET) = 12.06  
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.78  
PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.93  
STREET FLOW TRAVEL TIME (MIN.) = 3.10 Tc (MIN.) = 11.38

\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.029  
SUBAREA LOSS RATE DATA (AMC II):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN

RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 1.35 0.20 0.400 0.400 75  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA (ACRES) = 1.35 SUBAREA RUNOFF (CFS) = 3.58  
EFFECTIVE AREA (ACRES) = 1.97 AREA-AVERAGED Fp (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
TOTAL AREA (ACRES) = 2.0 PEAK FLOW RATE (CFS) = 5.23

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH (FEET) = 0.37 HALFSTREET FLOW WIDTH (FEET) = 13.79  
FLOW VELOCITY (FEET/SEC.) = 3.01 DEPTH\*VELOCITY (FT\*FT/SEC.) = 1.10  
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 9.00 = 810.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 9.00 TO NODE 9.00 IS CODE = 1  
\*\*\*\*\*

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<

=====

TOTAL NUMBER OF STREAMS = 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION (MIN.) = 11.38  
RAINFALL INTENSITY (INCH/HR) = 3.03  
AREA-AVERAGED Fp (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20  
AREA-AVERAGED Ap = 0.40  
EFFECTIVE STREAM AREA (ACRES) = 1.97  
TOTAL STREAM AREA (ACRES) = 1.97  
PEAK FLOW RATE (CFS) AT CONFLUENCE = 5.23

\*\*\*\*\*  
FLOW PROCESS FROM NODE 7.00 TO NODE 8.00 IS CODE = 21  
\*\*\*\*\*

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<

>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 275.00

ELEVATION DATA: UPSTREAM (FEET) = 792.50 DOWNSTREAM (FEET) = 787.00

Tc = K\*((LENGTH\*\* 3.00)/(ELEVATION CHANGE))\*\*0.20

SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.273

\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.627

SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)

RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 0.62 0.20 0.400 0.400 75 8.27  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA RUNOFF (CFS) = 1.98  
TOTAL AREA (ACRES) = 0.62 PEAK FLOW RATE (CFS) = 1.98

\*\*\*\*\*  
FLOW PROCESS FROM NODE 5.00 TO NODE 9.00 IS CODE = 62  
\*\*\*\*\*

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<

>>>>(STREET TABLE SECTION # 1 USED)<<<<<<

=====

UPSTREAM ELEVATION (FEET) = 787.80 DOWNSTREAM ELEVATION (FEET) = 780.00

STREET LENGTH (FEET) = 518.00 CURB HEIGHT (INCHES) = 6.0

STREET HALFWIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL, GRADEBREAK (FEET) = 13.00

INSIDE STREET CROSSFALL (DECIMAL) = 0.017

LONGEST FLOWPATH FROM NODE 7.00 TO NODE 9.00 = 745.00 FEET.

\*\*\*\*\* FLOW PROCESS FROM NODE 9.00 TO NODE 9.00 IS CODE = 1 \*\*\*\*\*

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<  
>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
TIME OF CONCENTRATION (MIN.) = 10.64  
RAINFALL INTENSITY (INCH/HR) = 3.15  
AREA-AVERAGED Fm (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20  
AREA-AVERAGED Ap = 0.40  
EFFECTIVE STREAM AREA (ACRES) = 1.69  
TOTAL STREAM AREA (ACRES) = 1.69  
PEAK FLOW RATE (CFS) AT CONFLUENCE = 4.66

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	5.23	11.38	3.029	0.20 (0.08)	0.40	2.0	4.00
2	4.66	10.64	3.146	0.20 (0.08)	0.40	1.7	7.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	9.75	10.64	3.146	0.20 (0.08)	0.40	3.5	7.00
2	9.71	11.38	3.029	0.20 (0.08)	0.40	3.7	4.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
PEAK FLOW RATE (CFS) = 9.75 Tc (MIN.) = 10.64  
EFFECTIVE AREA (ACRES) = 3.53 AREA-AVERAGED Fm (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
TOTAL AREA (ACRES) = 3.7  
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 9.00 = 810.00 FEET.

\*\*\*\*\* FLOW PROCESS FROM NODE 9.00 TO NODE 14.00 IS CODE = 31 \*\*\*\*\*

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

ELEVATION DATA: UPSTREAM (FEET) = 780.00 DOWNSTREAM (FEET) = 777.00  
FLOW LENGTH (FEET) = 298.00 MANNING'S N = 0.013  
DEPTH OF FLOW IN 18.0 INCH PIPE IS 14.4 INCHES  
PIPE-FLOW VELOCITY (FEET/SEC.) = 6.45  
ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1  
PIPE-FLOW (CFS) = 9.75  
PIPE TRAVEL TIME (MIN.) = 0.77 Tc (MIN.) = 11.41  
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 14.00 = 1108.00 FEET.

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)] \*\* 0.20  
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 7.734  
\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.768  
SUBAREA Tc AND LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN	Tc (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE"	D	0.54	0.20	0.400	75	7.73
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400 SUBAREA RUNOFF (CFS) = 1.79 TOTAL AREA (ACRES) = 0.54 PEAK FLOW RATE (CFS) = 1.79						

\*\*\*\*\* FLOW PROCESS FROM NODE 8.00 TO NODE 9.00 IS CODE = 62 \*\*\*\*\*

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
>>>>(STREET TABLE SECTION # 1 USED)<<<<<<

UPSTREAM ELEVATION (FEET) = 787.00 DOWNSTREAM ELEVATION (FEET) = 780.00  
STREET LENGTH (FEET) = 470.00 CURB HEIGHT (INCHES) = 6.0  
STREET HALF WIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00  
INSIDE STREET CROSSFALL (DECIMAL) = 0.017  
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017

SPECIFIED NUMBER OF HALFSIDEWAYS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\* TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 3.39  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
STREET FLOW DEPTH (FEET) = 0.33  
HALF STREET FLOOD WIDTH (FEET) = 11.55  
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.70  
PRODUCT OF DEPTH & VELOCITY (FT\*FT/SEC.) = 0.88  
STREET FLOW TRAVEL TIME (MIN.) = 2.90 Tc (MIN.) = 10.64  
\* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.146

SUBAREA LOSS RATE DATA (AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
RESIDENTIAL "8-10 DWELLINGS/ACRE"	D	1.15	0.20	0.400	75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400 SUBAREA AREA (ACRES) = 1.15 SUBAREA RUNOFF (CFS) = 3.17 EFFECTIVE AREA (ACRES) = 1.69 AREA-AVERAGED Fm (INCH/HR) = 0.08 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40 TOTAL AREA (ACRES) = 1.7 PEAK FLOW RATE (CFS) = 4.66					

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH (FEET) = 0.35 HALF STREET FLOOD WIDTH (FEET) = 13.18  
FLOW VELOCITY (FEET/SEC.) = 2.92 DEPTH \* VELOCITY (FT\*FT/SEC.) = 1.04





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SUBAREA RUNOFF(CFS) = 1.50
TOTAL AREA(ACRES) = 0.47 PEAK FLOW RATE(CFS) = 1.50
*****
FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.27
RAINFALL INTENSITY(INCH/HR) = 3.63
AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 0.47
TOTAL STREAM AREA(ACRES) = 0.47
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.50
*****
FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 259.00
ELEVATION DATA: UPSTREAM(FEET) = 787.30 DOWNSTREAM(FEET) = 783.30
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.951
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.710
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
*8-10 DWELLINGS/ACRE" D 0.56 0.20 0.400 75 7.95
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA RUNOFF(CFS) = 1.83
TOTAL AREA(ACRES) = 0.56 PEAK FLOW RATE(CFS) = 1.83
*****
FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 62
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 783.30 DOWNSTREAM ELEVATION(FEET) = 777.90
STREET LENGTH(FEET) = 340.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

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SUBAREA AREA(ACRES) = 0.44 SUBAREA RUNOFF(CFS) = 1.60
EFFECTIVE AREA(ACRES) = 0.93 AREA-AVERAGED Fm(INCH/HR) = 0.05
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.27
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 3.38
*****
FLOW PROCESS FROM NODE 18.00 TO NODE 22.00 IS CODE = 31
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 780.40 DOWNSTREAM(FEET) = 777.90
FLOW LENGTH(FEET) = 153.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.09
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.38
PIPE TRAVEL TIME(MIN.) = 0.42 Tc(MIN.) = 7.12
LONGEST FLOWPATH FROM NODE 15.00 TO NODE 22.00 = 491.00 FEET.
*****
FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 7.12
RAINFALL INTENSITY(INCH/HR) = 3.95
AREA-AVERAGED Fm(INCH/HR) = 0.05
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.27
EFFECTIVE STREAM AREA(ACRES) = 0.93
TOTAL STREAM AREA(ACRES) = 0.93
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.38
*****
FLOW PROCESS FROM NODE 19.00 TO NODE 22.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 300.00
ELEVATION DATA: UPSTREAM(FEET) = 783.00 DOWNSTREAM(FEET) = 777.90
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.272
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.628
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
*8-10 DWELLINGS/ACRE" D 0.47 0.20 0.400 75 8.27
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400

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STREET PARKWAY CROSSFALL (DECIMAL) = 0.020  
 Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150  
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 3.07  
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
 STREET FLOW DEPTH (FEET) = 0.32

HALF-STREET FLOOD WIDTH (FEET) = 10.89  
 AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.72  
 PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.86  
 STREET FLOW TRAVEL TIME (MIN.) = 2.08 Tc (MIN.) = 10.03  
 \* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.252

SUBAREA LOSS RATE DATA (AFC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN

RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" D 0.87 0.20 0.400 0.400 75  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA AREA (ACRES) = 0.87 SUBAREA RUNOFF (CFS) = 2.48  
 EFFECTIVE AREA (ACRES) = 1.43 AREA-AVERAGED Fp (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA (ACRES) = 1.4 PEAK FLOW RATE (CFS) = 4.08

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH (FEET) = 0.34 HALF-STREET FLOOD WIDTH (FEET) = 12.35  
 FLOW VELOCITY (FEET/SEC.) = 2.88 DEPTH\*VELOCITY (FT\*FT/SEC.) = 0.98  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 599.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

=====

TOTAL NUMBER OF STREAMS = 3  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:  
 TIME OF CONCENTRATION (MIN.) = 10.03  
 RAINFALL INTENSITY (INCH/HR) = 3.25  
 AREA-AVERAGED Fp (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.40  
 EFFECTIVE STREAM AREA (ACRES) = 1.43  
 TOTAL STREAM AREA (ACRES) = 1.43  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 4.08

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	3.38	7.12	3.948	0.20 (0.05)	0.27	0.9	15.00
2	1.50	8.27	3.628	0.20 (0.08)	0.40	0.5	19.00
3	4.08	10.03	3.252	0.20 (0.08)	0.40	1.4	20.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
 CONFLUENCE FORMULA USED FOR 3 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	8.32	7.12	3.948	0.20 (0.07)	0.35	2.3	15.00
2	8.36	8.27	3.628	0.20 (0.07)	0.35	2.6	19.00
3	8.20	10.03	3.252	0.20 (0.07)	0.36	2.8	20.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 8.36 Tc (MIN.) = 8.27  
 EFFECTIVE AREA (ACRES) = 2.58 AREA-AVERAGED Fp (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 2.8  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 22.00 = 599.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 22.00 TO NODE 25.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 777.90 DOWNSTREAM (FEET) = 777.30  
 FLOW LENGTH (FEET) = 37.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 10.7 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 7.67  
 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 8.36  
 PIPE TRAVEL TIME (MIN.) = 0.08 Tc (MIN.) = 8.35  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 25.00 = 636.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 25.00 TO NODE 25.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<

=====

TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
 TIME OF CONCENTRATION (MIN.) = 8.35  
 RAINFALL INTENSITY (INCH/HR) = 3.61  
 AREA-AVERAGED Fp (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.35  
 EFFECTIVE STREAM AREA (ACRES) = 2.58  
 TOTAL STREAM AREA (ACRES) = 2.83  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 8.36

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 23.00 TO NODE 24.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<

>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 147.00  
 ELEVATION DATA: UPSTREAM (FEET) = 782.50 DOWNSTREAM (FEET) = 780.30  
 Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)]\*\* 0.20  
 SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 5.185



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*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 7.59
RAINFALL INTENSITY(INCH/HR) = 3.81
AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.34
EFFECTIVE STREAM AREA(ACRES) = 2.83
TOTAL STREAM AREA(ACRES) = 3.31
PEAK FLOW RATE(CFS) AT CONFLUENCE = 9.98
*****
FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 147.00
ELEVATION DATA: UPSTREAM(FEET) = 780.50 DOWNSTREAM(FEET) = 778.30

TC = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)] ** 0.20
SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 5.185
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.725
SUBAREA TC AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN (MIN.)
COMMERCIAL D 0.11 0.20 0.100 75 5.19
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.47
TOTAL AREA(ACRES) = 0.11 PEAK FLOW RATE(CFS) = 0.47
*****
FLOW PROCESS FROM NODE 27.00 TO NODE 28.00 IS CODE = 62
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 1 USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 778.30 DOWNSTREAM ELEVATION(FEET) = 774.50
STREET LENGTH(FEET) = 170.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 13.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017

SPECIFIED NUMBER OF HALFBREAKS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.14
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.24
HALFSTREET FLOW WIDTH(FEET) = 6.27
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.50
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.59
STREET FLOW TRAVEL TIME(MIN.) = 1.13 TC(MIN.) = 6.32
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.225
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN
RESIDENTIAL D 0.36 0.20 0.400 75
"8-10 DWELLINGS/ACRE"
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.36 SUBAREA RUNOFF(CFS) = 1.34
EFFECTIVE AREA(ACRES) = 0.47 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.33
TOTAL AREA(ACRES) = 0.5 PEAK FLOW RATE(CFS) = 1.76

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.26 HALFSTREET FLOW WIDTH(FEET) = 7.79
FLOW VELOCITY(FEET/SEC.) = 2.76 DEPTH*VELOCITY(FT*FT/SEC.) = 0.73
LONGEST FLOWPATH FROM NODE 26.00 TO NODE 28.00 = 317.00 FEET.
*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 81
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
MAINLINE TC(MIN.) = 6.32
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.225
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN
RESIDENTIAL D 0.47 0.20 0.400 75
"8-10 DWELLINGS/ACRE"
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.47 SUBAREA RUNOFF(CFS) = 1.75
EFFECTIVE AREA(ACRES) = 0.94 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.36
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 3.51
*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.32
RAINFALL INTENSITY(INCH/HR) = 4.22
AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20

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RAINFALL INTENSITY (INCH/HR) = 3.78  
 AREA-AVERAGED Fm (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.35  
 EFFECTIVE STREAM AREA (ACRES) = 3.77  
 TOTAL STREAM AREA (ACRES) = 4.25  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 13.15

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.10 TO NODE 28.20 IS CODE = 21  
 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
 >>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 265.00  
 ELEVATION DATA: UPSTREAM (FEET) = 779.50 DOWNSTREAM (FEET) = 774.80  
 Tc = K \* ((LENGTH \*\* 3.00) / (ELEVATION CHANGE)) \*\* 0.20  
 SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 7.805  
 \* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.749  
 SUBAREA Tc AND LOSS RATE DATA (AMC II):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" D 0.55 0.20 0.400 75 7.81  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA RUNOFF (CFS) = 1.82  
 TOTAL AREA (ACRES) = 0.55 PEAK FLOW RATE (CFS) = 1.82

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.20 TO NODE 29.00 IS CODE = 62  
 >>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
 >>>>(STREET TABLE SECTION # 1 USED)<<<<<<

UPSTREAM ELEVATION (FEET) = 774.80 DOWNSTREAM ELEVATION (FEET) = 774.30  
 STREET LENGTH (FEET) = 62.00 CURB HEIGHT (INCHES) = 6.0  
 STREET HALFWIDTH (FEET) = 18.00  
 DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00  
 INSIDE STREET CROSSFALL (DECIMAL) = 0.017  
 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017  
 SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1  
 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020  
 Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150  
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 2.45  
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
 STREET FLOW DEPTH (FEET) = 0.33  
 HALFSTREET FLOW WIDTH (FEET) = 11.45  
 AVERAGE FLOW VELOCITY (FEET/SEC.) = 1.98  
 PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.65  
 STREET FLOW TRAVEL TIME (MIN.) = 0.52 Tc (MIN.) = 8.33

AREA-AVERAGED Ap = 0.36  
 EFFECTIVE STREAM AREA (ACRES) = 0.94  
 TOTAL STREAM AREA (ACRES) = 0.94  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 3.51

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	9.64	6.63	4.112	0.20 (0.07)	0.34	2.5	23.00
1	9.98	7.59	3.810	0.20 (0.07)	0.34	2.8	15.00
1	9.89	8.74	3.517	0.20 (0.07)	0.35	3.1	19.00
1	9.57	10.50	3.169	0.20 (0.07)	0.35	3.3	20.00
2	3.51	6.32	4.225	0.20 (0.07)	0.36	0.9	26.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	12.96	6.32	4.225	0.20 (0.07)	0.35	3.3	26.00
2	13.05	6.63	4.112	0.20 (0.07)	0.35	3.5	23.00
3	13.15	7.59	3.810	0.20 (0.07)	0.35	3.8	15.00
4	12.81	8.74	3.517	0.20 (0.07)	0.35	4.0	19.00
5	12.19	10.50	3.169	0.20 (0.07)	0.36	4.2	20.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
 PEAK FLOW RATE (CFS) = 13.15 Tc (MIN.) = 7.59  
 EFFECTIVE AREA (ACRES) = 3.77 AREA-AVERAGED Fm (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 4.2  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 28.00 = 816.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.00 TO NODE 29.00 IS CODE = 31  
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

ELEVATION DATA: UPSTREAM (FEET) = 774.50 DOWNSTREAM (FEET) = 774.30  
 PIPE LENGTH (FEET) = 36.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 24.0 INCH PIPE IS 16.6 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 5.68  
 ESTIMATED PIPE DIAMETER (INCH) = 24.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 13.15  
 PIPE TRAVEL TIME (MIN.) = 0.11 Tc (MIN.) = 7.69  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 29.00 = 852.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 29.00 TO NODE 29.00 IS CODE = 1  
 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<  
 \*\*\*\*\*  
 TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
 TIME OF CONCENTRATION (MIN.) = 7.69





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=====
ELEVATION DATA: UPSTREAM(FEET) = 773.70  DOWNSTREAM(FEET) = 772.30
FLOW LENGTH(FEET) = 277.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 27.0 INCH PIPE IS 20.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 5.96
ESTIMATED PIPE DIAMETER(INCH) = 27.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 19.22
PIPE TRAVEL TIME(MIN.) = 0.77  Tc(MIN.) = 8.82
PIPE FLOW FROM NODE 20.00 TO NODE 38.00 = 1252.00 FEET.
LONGEST FLOWPATH FROM NODE
*****
FLOW PROCESS FROM NODE 38.00 TO NODE 38.00 IS CODE = 10
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<
=====
*****
FLOW PROCESS FROM NODE 33.00 TO NODE 34.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 266.00
ELEVATION DATA: UPSTREAM(FEET) = 788.00  DOWNSTREAM(FEET) = 784.30
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.207
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.644
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"8-10 DWELLINGS/ACRE" D 0.53 0.20 0.40 75 8.21
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
SUBAREA RUNOFF(CFS) = 1.70
TOTAL AREA(ACRES) = 0.53  PEAK FLOW RATE(CFS) = 1.70
*****
FLOW PROCESS FROM NODE 34.00 TO NODE 37.00 IS CODE = 62
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED) <<<<
=====
UPSTREAM ELEVATION(FEET) = 784.30  DOWNSTREAM ELEVATION(FEET) = 777.60
STREET LENGTH(FEET) = 623.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 3.11
STREETFLOW MODE, RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.33
HALFSTREET FLOOD WIDTH(FEET) = 11.92
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.34
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.78
STREET FLOW TRAVEL TIME(MIN.) = 4.44  Tc(MIN.) = 12.65
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 2.853
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" D 1.12 0.20 0.40 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.40
SUBAREA AREA(ACRES) = 1.12  SUBAREA RUNOFF(CFS) = 2.79
EFFECTIVE AREA(ACRES) = 1.65  AREA-AVERAGED Fp(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 1.6  PEAK FLOW RATE(CFS) = 4.12
END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36  HALFSTREET FLOOD WIDTH(FEET) = 13.38
FLOW VELOCITY(FEET/SEC.) = 2.51  DEPTH*VELOCITY(FT*FT/SEC.) = 0.90
LONGEST FLOWPATH FROM NODE 33.00 TO NODE 37.00 = 889.00 FEET.
*****
FLOW PROCESS FROM NODE 37.00 TO NODE 37.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 12.65
RAINFALL INTENSITY(INCH/HR) = 2.85
AREA-AVERAGED Fp(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 1.65
TOTAL STREAM AREA(ACRES) = 1.65
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.12
*****
FLOW PROCESS FROM NODE 36.00 TO NODE 37.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
ELEVATION DATA: UPSTREAM(FEET) = 778.70  DOWNSTREAM(FEET) = 777.60
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.824
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc

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*****
FLOW PROCESS FROM NODE 38.00 TO NODE 40.00 IS CODE = 31
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<
=====
ELEVATION DATA: UPSTREAM( FEET) = 772.30 DOWNSTREAM( FEET) = 772.00
FLOW LENGTH( FEET) = 65.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 30.0 INCH PIPE IS 21.9 INCHES
PIPE-FLOW VELOCITY( FEET/SEC.) = 6.08
ESTIMATED PIPE DIAMETER( INCH) = 30.00 NUMBER OF PIPES = 1
PIPE-FLOW( CFS) = 23.28
PIPE TRAVEL TIME( MIN.) = 0.18 Tc( MIN.) = 9.00
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 40.00 = 1317.00 FEET.
*****
FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION( MIN.) = 9.00
RAINFALL INTENSITY( INCH/HR) = 3.46
AREA-AVERAGED Fm( INCH/HR) = 0.07
AREA-AVERAGED Fp( INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.34
EFFECTIVE STREAM AREA( ACRES) = 6.91
TOTAL STREAM AREA( ACRES) = 8.01
PEAK FLOW RATE( CFS) AT CONFLUENCE = 23.28
*****
FLOW PROCESS FROM NODE 39.00 TO NODE 40.00 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH( FEET) = 200.00
ELEVATION DATA: UPSTREAM( FEET) = 778.00 DOWNSTREAM( FEET) = 776.00
Tc = K * [ (LENGTH** 3.00) / (ELEVATION CHANGE) ]** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc( MIN.) = 6.357
* 25 YEAR RAINFALL INTENSITY( INCH/HR) = 4.211
SUBAREA Tc AND LOSS RATE DATA( AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.18 0.20 0.100 0.100 75 6.36
SUBAREA AVERAGE Pervious Loss Rate, Fp( INCH/HR) = 0.20
SUBAREA AVERAGE Pervious Area Fraction, Ap = 0.100
SUBAREA RUNOFF( CFS) = 0.68
TOTAL AREA( ACRES) = 0.18 PEAK FLOW RATE( CFS) = 0.68
*****
FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1

```

```

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION( MIN.) = 6.36
RAINFALL INTENSITY( INCH/HR) = 4.21
AREA-AVERAGED Fm( INCH/HR) = 0.02
AREA-AVERAGED Fp( INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA( ACRES) = 0.18
TOTAL STREAM AREA( ACRES) = 0.18
PEAK FLOW RATE( CFS) AT CONFLUENCE = 0.68
*****
FLOW PROCESS FROM NODE 39.10 TO NODE 39.20 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH( FEET) = 283.00
ELEVATION DATA: UPSTREAM( FEET) = 781.00 DOWNSTREAM( FEET) = 777.70
Tc = K * [ (LENGTH** 3.00) / (ELEVATION CHANGE) ]** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc( MIN.) = 7.549
* 25 YEAR RAINFALL INTENSITY( INCH/HR) = 3.820
SUBAREA Tc AND LOSS RATE DATA( AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL "11+ DWELLINGS/ACRE" D 0.31 0.20 0.200 0.200 75 7.55
SUBAREA AVERAGE Pervious Loss Rate, Fp( INCH/HR) = 0.20
SUBAREA AVERAGE Pervious Area Fraction, Ap = 0.200
SUBAREA RUNOFF( CFS) = 1.05
TOTAL AREA( ACRES) = 0.31 PEAK FLOW RATE( CFS) = 1.05
*****
FLOW PROCESS FROM NODE 39.20 TO NODE 40.00 IS CODE = 62
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>( STREET TABLE SECTION # 1 USED)<<<<<
=====
UPSTREAM ELEVATION( FEET) = 777.70 DOWNSTREAM ELEVATION( FEET) = 776.00
STREET LENGTH( FEET) = 125.00 CURB HEIGHT( INCHES) = 6.0
STREET HALFWIDTH( FEET) = 18.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK( FEET) = 13.00
INSIDE STREET CROSSFALL( DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL( DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL( DECIMAL) = 0.020
Manning's Friction Factor for Streetflow Section( curb-to-curb) = 0.0150
Manning's Friction Factor for Back-of-Walk Flow Section = 0.0200
*****
TRAVEL TIME COMPUTED USING ESTIMATED FLOW( CFS) = 2.04

```

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOOD DEPTH (FEET) = 0.29  
 HALFSTREET FLOOD WIDTH (FEET) = 9.42  
 AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.33  
 PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.68  
 STREET FLOW TRAVEL TIME (MIN.) = 0.89 Tc (MIN.) = 8.44  
 \* 25 YEAR RAINFALL INTENSITY (INCH/HR) = 3.586  
 SUBAREA LOSS RATE DATA (AMC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN SCS  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 RESIDENTIAL  
 "5-7 DWELLINGS/ACRE" D 0.63 0.20 0.500 75  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500  
 SUBAREA AREA (ACRES) = 0.63 SUBAREA RUNOFF (CFS) = 1.98  
 EFFECTIVE AREA (ACRES) = 0.94 AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA (ACRES) = 0.9 PEAK FLOW RATE (CFS) = 2.97

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH (FEET) = 0.32 HALFSTREET FLOOD WIDTH (FEET) = 11.14  
 FLOW VELOCITY (FEET/SEC.) = 2.52 DEPTH\*VELOCITY (FT\*FT/SEC.) = 0.81  
 LONGEST FLOWPATH FROM NODE 39.10 TO NODE 40.00 = 408.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<

>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<

=====

TOTAL NUMBER OF STREAMS = 3

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:

TIME OF CONCENTRATION (MIN.) = 8.44  
 RAINFALL INTENSITY (INCH/HR) = 3.59  
 AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.40  
 EFFECTIVE STREAM AREA (ACRES) = 0.94  
 TOTAL STREAM AREA (ACRES) = 0.94  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 2.97

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	19.45	5.26	4.689	0.20 (0.07)	0.34	4.1	36.00
1	22.72	7.74	3.768	0.20 (0.07)	0.34	6.1	26.00
1	22.79	7.81	3.746	0.20 (0.07)	0.34	6.1	30.00
1	22.92	8.04	3.686	0.20 (0.07)	0.34	6.3	23.00
1	23.28	9.00	3.459	0.20 (0.07)	0.34	6.9	15.00
1	23.27	9.63	3.328	0.20 (0.07)	0.35	7.2	28.10
1	22.98	10.15	3.231	0.20 (0.07)	0.35	7.4	19.00
1	22.01	11.93	2.949	0.20 (0.07)	0.35	7.9	20.00
1	21.35	12.89	2.822	0.20 (0.07)	0.35	8.0	33.00
2	0.68	6.36	4.211	0.20 (0.02)	0.10	0.2	39.00
3	2.97	8.44	3.586	0.20 (0.08)	0.40	0.9	39.10

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 3 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	22.50	5.26	4.689	0.20 (0.07)	0.34	4.9	36.00
2	24.21	6.36	4.211	0.20 (0.07)	0.34	5.9	39.00
3	26.19	7.74	3.768	0.20 (0.07)	0.34	7.1	26.00
4	26.26	7.81	3.746	0.20 (0.07)	0.34	7.2	30.00
5	26.42	8.04	3.686	0.20 (0.07)	0.34	7.4	23.00
6	26.62	8.44	3.586	0.20 (0.07)	0.34	7.7	39.10
7	26.70	9.00	3.459	0.20 (0.07)	0.35	8.0	15.00
8	26.56	9.63	3.328	0.20 (0.07)	0.35	8.4	28.10
9	26.17	10.15	3.231	0.20 (0.07)	0.35	8.5	19.00
10	24.91	11.93	2.949	0.20 (0.07)	0.35	9.0	20.00
11	24.13	12.89	2.822	0.20 (0.07)	0.35	9.1	33.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 26.70 Tc (MIN.) = 9.00  
 EFFECTIVE AREA (ACRES) = 8.03 AREA-AVERAGED Fm (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 9.1  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 40.00 = 1317.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 40.00 TO NODE 41.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<

>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 772.00 DOWNSTREAM (FEET) = 771.80  
 FLOW LENGTH (FEET) = 38.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 30.0 INCH PIPE IS 23.2 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 6.54  
 ESTIMATED PIPE DIAMETER (INCH) = 30.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 26.70  
 PIPE TRAVEL TIME (MIN.) = 0.10 Tc (MIN.) = 9.09  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 41.00 = 1355.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 41.00 TO NODE 41.00 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<<

=====

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	22.50	5.36	4.640	0.20 (0.07)	0.34	4.9	36.00
2	24.21	6.46	4.174	0.20 (0.07)	0.34	5.9	39.00
3	26.19	7.83	3.742	0.20 (0.07)	0.34	7.1	26.00
4	26.26	7.91	3.720	0.20 (0.07)	0.34	7.2	30.00
5	26.42	8.14	3.661	0.20 (0.07)	0.34	7.4	23.00
6	26.62	8.54	3.563	0.20 (0.07)	0.34	7.7	39.10
7	26.70	9.09	3.438	0.20 (0.07)	0.35	8.0	15.00

8 26.56 9.73 3.309 0.20( 0.07) 0.35 8.4 28.10  
 9 26.17 10.25 3.213 0.20( 0.07) 0.35 8.5 19.00  
 10 24.91 12.03 2.935 0.20( 0.07) 0.35 9.0 20.00  
 11 24.13 12.99 2.810 0.20( 0.07) 0.35 9.1 33.00  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 41.00 = 1355.00 FEET.

\*\* MEMORY BANK # 1 CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Ft) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	11.17	8.22	3.642	0.20( 0.08)	0.40	3.4	12.00
2	11.97	11.46	3.016	0.20( 0.08)	0.40	4.4	7.00
3	11.86	12.20	2.911	0.20( 0.08)	0.40	4.5	4.00

LONGEST FLOWPATH FROM NODE 4.00 TO NODE 41.00 = 1161.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Ft) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	31.83	5.36	4.640	0.20( 0.07)	0.36	7.1	36.00
2	34.30	6.46	4.174	0.20( 0.07)	0.36	8.5	39.00
3	37.13	7.83	3.742	0.20( 0.07)	0.36	10.3	26.00
4	37.25	7.91	3.720	0.20( 0.07)	0.36	10.4	30.00
5	37.55	8.14	3.661	0.20( 0.07)	0.36	10.7	23.00
6	37.63	8.22	3.642	0.20( 0.07)	0.36	10.8	12.00
7	37.87	8.54	3.563	0.20( 0.07)	0.36	11.1	39.10
8	38.09	9.09	3.438	0.20( 0.07)	0.36	11.7	15.00
9	38.10	9.73	3.309	0.20( 0.07)	0.36	12.2	28.10
10	37.84	10.25	3.213	0.20( 0.07)	0.37	12.5	19.00
11	37.28	11.46	3.016	0.20( 0.07)	0.37	13.2	7.00
12	36.79	12.03	2.935	0.20( 0.07)	0.37	13.5	20.00
13	36.63	12.20	2.911	0.20( 0.07)	0.37	13.5	4.00
14	35.56	12.99	2.810	0.20( 0.07)	0.37	13.6	33.00

TOTAL AREA(ACRES) = 13.6

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 38.10 Tc(MIN.) = 9.729  
 EFFECTIVE AREA(ACRES) = 12.19 AREA-AVERAGED Fp(INCH/HR) = 0.07  
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.36  
 TOTAL AREA(ACRES) = 13.6  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 41.00 = 1355.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 41.00 TO NODE 41.00 IS CODE = 12

>>>>>CLEAR MEMORY BANK # 1 <<<<<<

\*\*\*\*\*

FLOW PROCESS FROM NODE 41.00 TO NODE 46.00 IS CODE = 31

\*\*\*\*\*

FLOW PROCESS FROM NODE 41.00 TO NODE 46.00 IS CODE = 31

\*\*\*\*\*

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

\*\*\*\*\*

ELEVATION DATA: UPSTREAM(FEET) = 771.80 DOWNSTREAM(FEET) = 768.80

FLOW LENGTH(FEET) = 328.00 MANNING'S N = 0.013

DEPTH OF FLOW IN 33.0 INCH PIPE IS 22.2 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 8.96

ESTIMATED PIPE DIAMETER(INCH) = 33.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 38.10  
 PIPE TRAVEL TIME(MIN.) = 0.61 Tc(MIN.) = 10.34  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 46.00 = 1683.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 46.00 TO NODE 46.00 IS CODE = 1

\*\*\*\*\*

>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<

\*\*\*\*\*

TOTAL NUMBER OF STREAMS = 2

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:

TIME OF CONCENTRATION(MIN.) = 10.34

RAINFALL INTENSITY(INCH/HR) = 3.20

AREA-AVERAGED Fp(INCH/HR) = 0.07

AREA-AVERAGED Ap = 0.20

EFFECTIVE STREAM AREA(ACRES) = 12.19

TOTAL STREAM AREA(ACRES) = 13.63

PEAK FLOW RATE(CFS) AT CONFLUENCE = 38.10

\*\*\*\*\*

FLOW PROCESS FROM NODE 43.00 TO NODE 44.00 IS CODE = 21

\*\*\*\*\*

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

>>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

\*\*\*\*\*

INITIAL SUBAREA FLOW-LENGTH(FEET) = 280.00

ELEVATION DATA: UPSTREAM(FEET) = 776.80 DOWNSTREAM(FEET) = 774.00

\*\*\*\*\*

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)] \*\* 0.20

SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.752

\* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.764

SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/	SCS SOIL AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS Tc (MIN.)
LAND USE				
RESIDENTIAL				
"11+ DWELLINGS/ACRE"	D	0.85	0.20	0.200
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20				7.75
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200				
SUBAREA RUNOFF(CFS) = 2.85				
TOTAL AREA(ACRES) = 0.85				2.85

\*\*\*\*\*

FLOW PROCESS FROM NODE 44.00 TO NODE 45.00 IS CODE = 31

\*\*\*\*\*

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

\*\*\*\*\*

ELEVATION DATA: UPSTREAM(FEET) = 774.00 DOWNSTREAM(FEET) = 770.00

FLOW LENGTH(FEET) = 400.00 MANNING'S N = 0.013

ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000

DEPTH OF FLOW IN 18.0 INCH PIPE IS 6.6 INCHES

PIPE-FLOW VELOCITY(FEET/SEC.) = 4.87

ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1

PIPE-FLOW(CFS) = 2.85

PIPE TRAVEL TIME(MIN.) = 1.37 Tc(MIN.) = 9.12  
LONGEST FLOWPATH FROM NODE 43.00 TO NODE 45.00 = 680.00 FEET.  
\*\*\*\*\*  
FLOW PROCESS FROM NODE 45.00 TO NODE 45.00 IS CODE = 81  
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<  
=====

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)	(ACRES)	NODE
1	31.83	6.00	4.352	0.20	0.07	0.36
1	34.30	7.09	3.958	0.20	0.07	0.36
1	37.13	8.47	3.581	0.20	0.07	0.36
1	37.25	8.52	3.567	0.20	0.07	0.36
1	37.55	8.75	3.514	0.20	0.07	0.36
1	37.63	8.83	3.497	0.20	0.07	0.36
1	37.87	9.15	3.427	0.20	0.07	0.36
1	38.09	9.70	3.314	0.20	0.07	0.36
1	38.10	10.34	3.197	0.20	0.07	0.36
1	37.84	10.86	3.110	0.20	0.07	0.37
1	37.28	12.07	2.929	0.20	0.07	0.37
1	36.79	12.66	2.851	0.20	0.07	0.37
1	36.63	12.83	2.829	0.20	0.07	0.37
1	35.56	13.62	2.735	0.20	0.07	0.37
2	27.69	9.72	3.312	0.20	0.04	0.20

MAINLINE Tc(MIN.) = 9.12  
\* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.432  
SUBAREA LOSS RATE DATA(AMC II):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
LAND USE (ACRES) (INCH/HR) (DECIMAL) CN  
RESIDENTIAL  
"11+ DWELLINGS/ACRE" D 8.22 0.20 0.200 75  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.20  
SUBAREA AREA(ACRES) = 8.22 SUBAREA RUNOFF(CFS) = 25.10  
EFFECTIVE AREA(ACRES) = 9.07 AREA-AVERAGED Fm(INCH/HR) = 0.04  
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20  
TOTAL AREA(ACRES) = 9.1 PEAK FLOW RATE(CFS) = 27.69  
\*\*\*\*\*

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	54.35	6.00	4.352	0.20	0.06	0.29	36.00
2	58.50	7.09	3.958	0.20	0.06	0.29	39.00
3	63.24	8.47	3.581	0.20	0.06	0.29	26.00
4	63.44	8.52	3.567	0.20	0.06	0.29	30.00
5	64.03	8.75	3.514	0.20	0.06	0.29	23.00
6	64.21	8.83	3.497	0.20	0.06	0.29	12.00
7	64.86	9.15	3.427	0.20	0.06	0.29	39.10
8	65.76	9.70	3.314	0.20	0.06	0.29	15.00
9	65.78	9.72	3.312	0.20	0.06	0.29	43.00
10	64.83	10.34	3.197	0.20	0.06	0.29	28.10
11	63.82	10.86	3.110	0.20	0.06	0.30	19.00
12	61.73	12.07	2.929	0.20	0.06	0.30	22.3
13	60.59	12.66	2.851	0.20	0.06	0.30	20.00
14	60.23	12.83	2.829	0.20	0.06	0.30	4.00
15	58.37	13.62	2.735	0.20	0.06	0.30	33.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 65.78 Tc(MIN.) = 9.72  
EFFECTIVE AREA(ACRES) = 20.75 AREA-AVERAGED Fm(INCH/HR) = 0.06  
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.29  
TOTAL AREA(ACRES) = 22.7  
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 46.00 = 1683.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 46.00 TO NODE 50.00 IS CODE = 31  
\*\*\*\*\*

>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<

>>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

=====

ELEVATION DATA:	UPSTREAM( FEET)	=	768.80	DOWNSTREAM( FEET)	=	760.00
FLOW LENGTH( FEET)	=	55.00	MANNING'S N	=	0.013	
DEPTH OF FLOW IN	24.0 INCH PIPE IS	15.7 INCHES				
PIPE-FLOW VELOCITY( FEET/SEC.)	=	30.11				

\*\*\*\*\*

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ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 65.78
PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 9.75
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 50.00 = 1738.00 FEET.
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 9.75
RAINFALL INTENSITY(INCH/HR) = 3.31
AREA-AVERAGED Fp(INCH/HR) = 0.06
AREA-AVERAGED Ap = 0.29
EFFECTIVE STREAM AREA(ACRES) = 20.75
TOTAL STREAM AREA(ACRES) = 22.70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 65.78
*****
FLOW PROCESS FROM NODE 47.00 TO NODE 48.00 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 300.00
ELEVATION DATA: UPSTREAM(FEET) = 792.50 DOWNSTREAM(FEET) = 788.50
Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)]** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.308
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.039
SUBAREA Tc AND LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
".4 DWELLING/ACRE" D 0.12 0.20 0.900 75 11.31
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA RUNOFF(CFS) = 0.31
TOTAL AREA(ACRES) = 0.12 PEAK FLOW RATE(CFS) = 0.31
*****
FLOW PROCESS FROM NODE 48.00 TO NODE 49.00 IS CODE = 51
>>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<<
>>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 788.50 DOWNSTREAM(FEET) = 774.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 1050.00 CHANNEL SLOPE = 0.0138
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 2.529
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) (DECIMAL) CN
RESIDENTIAL
".4 DWELLING/ACRE" D 1.76 0.20 0.900 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA(ACRES) = 1.76 SUBAREA RUNOFF(CFS) = 3.71
EFFECTIVE AREA(ACRES) = 3.16 AREA-AVERAGED Fp(INCH/HR) = 0.18
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 3.22 PEAK FLOW RATE(CFS) = 6.66
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 1

```

```

LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
".4 DWELLING/ACRE" D 1.28 0.20 0.900 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.67
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.04
AVERAGE FLOW DEPTH(FEET) = 0.45 TRAVEL TIME(MIN.) = 4.34
Tc(MIN.) = 15.64
SUBAREA AREA(ACRES) = 1.28 SUBAREA RUNOFF(CFS) = 2.71
EFFECTIVE AREA(ACRES) = 1.40 AREA-AVERAGED Fp(INCH/HR) = 0.18
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 2.96
END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.56 FLOW VELOCITY(FEET/SEC.) = 4.69
LONGEST FLOWPATH FROM NODE 47.00 TO NODE 49.00 = 1350.00 FEET.
*****
FLOW PROCESS FROM NODE 49.00 TO NODE 50.00 IS CODE = 31
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 774.00 DOWNSTREAM(FEET) = 760.00
FLOW LENGTH(FEET) = 65.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 14.69
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 2.96
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 15.72
LONGEST FLOWPATH FROM NODE 47.00 TO NODE 50.00 = 1415.00 FEET.
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 81
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<
=====
MAINLINE Tc(MIN.) = 15.72
* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 2.522
SUBAREA LOSS RATE DATA(AMC II):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) (DECIMAL) CN
RESIDENTIAL
".4 DWELLING/ACRE" D 1.76 0.20 0.900 75
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.900
SUBAREA AREA(ACRES) = 1.76 SUBAREA RUNOFF(CFS) = 3.71
EFFECTIVE AREA(ACRES) = 3.16 AREA-AVERAGED Fp(INCH/HR) = 0.18
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 3.22 PEAK FLOW RATE(CFS) = 6.66
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 1

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ELEVATION DATA: UPSTREAM (FEET) = 792.80 DOWNSTREAM (FEET) = 789.70

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)]\*\*0.20
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.991
\* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.420
SUBAREA Tc AND LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
\*8-10 DWELLINGS/ACRE" D 0.61 0.20 0.400 91 8.99
SUBAREA AVERAGE Pervious LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE Pervious AREA FRACTION, Ap = 0.400
SUBAREA RUNOFF (CFS) = 2.38
TOTAL AREA (ACRES) = 0.61 PEAK FLOW RATE (CFS) = 2.38

\*\*\*\*\*
FLOW PROCESS FROM NODE 2.00 TO NODE 3.00 IS CODE = 62

>>>>> COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<
>>>>> (STREET TABLE SECTION # 1 USED)<<<<<<

UPSTREAM ELEVATION (FEET) = 789.70 DOWNSTREAM ELEVATION (FEET) = 784.60
STREET LENGTH (FEET) = 422.00 CURB HEIGHT (INCHES) = 6.0
STREET HALFWIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00
INSIDE STREET CROSSFALL (DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017

SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 4.22
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH (FEET) = 0.35
HALF-STREET FLOOD WIDTH (FEET) = 13.18
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.64
PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.94
STREET FLOW TRAVEL TIME (MIN.) = 2.66 Tc (MIN.) = 11.66
\* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.810
SUBAREA LOSS RATE DATA (AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
\*8-10 DWELLINGS/ACRE" D 1.09 0.20 0.400 91
SUBAREA AVERAGE Pervious LOSS RATE, Fp (INCH/HR) = 0.20
SUBAREA AVERAGE Pervious AREA FRACTION, Ap = 0.400
SUBAREA AREA (ACRES) = 1.09 SUBAREA RUNOFF (CFS) = 3.66
EFFECTIVE AREA (ACRES) = 1.70 AREA-AVERAGED Fm (INCH/HR) = 0.08
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA (ACRES) = 1.7 PEAK FLOW RATE (CFS) = 5.71

END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH (FEET) = 0.39 HALF-STREET FLOOD WIDTH (FEET) = 15.00

\*\*\*\*\*
RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)
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Ver. 20.0 Release Date: 06/01/2013 License ID 1239

Analysis prepared by:
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\*\*\*\*\* DESCRIPTION OF STUDY \*\*\*\*\*
\* W.O. 2118-8, EL TORO MATERIALS
\* 100-YR STUDY
\* PROPOSED CONDITION
\*\*\*\*\*

FILE NAME: ELTORO-P.DAT
TIME/DATE OF STUDY: 13:11 02/18/2014

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
\*\*\*\*\*
--\*TIME-OF-CONCENTRATION MODEL\*--
\*\*\*\*\*

USER SPECIFIED STORM EVENT (YEAR) = 100.00
SPECIFIED MINIMUM PIPE SIZE (INCH) = 18.00
SPECIFIED PERCENT OF GRADIENTS (DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
\*DATA BANK RAINFALL USED\*
\*ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR RATIONAL METHOD\*

Table with 10 columns: NO., HALF-CROWN TO STREET-CROSSFALL, IN-/OUT-/PARK, CURB GUTTER-GEOMETRIES, MANNING, WIDTH CROSSFALL, IN-/OUT-/PARK, HEIGHT, WIDTH, LIP, HIKE, FACTOR, (FT), SIDE / WAY, (FT), (FT), (n)

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth) \* (Velocity) Constraint = 6.0 (FT\*FT/S)
\*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*
FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21

>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
\*\*\*\*\*
INITIAL SUBAREA FLOW-LENGTH (FEET) = 292.00
\*\*\*\*\*

FLOW VELOCITY (FEET/SEC.) = 2.80 DEPTH\*VELOCITY (FT\*FT/SEC.) = 1.08  
LONGEST FLOWPATH FROM NODE 1.00 TO NODE 3.00 = 714.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 3.00 TO NODE 3.00 IS CODE = 81  
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<

=====

MAINLINE Tc (MIN.) = 11.66  
\* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.810  
SUBAREA LOSS RATE DATA (AMC III):  
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 1.21 0.20 0.400 91  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA (ACRES) = 1.21 SUBAREA RUNOFF (CFS) = 4.06  
EFFECTIVE AREA (ACRES) = 2.91 AREA-AVERAGED Fm (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
TOTAL AREA (ACRES) = 2.9 PEAK FLOW RATE (CFS) = 9.77

\*\*\*\*\*  
FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 292.00  
ELEVATION DATA: UPSTREAM (FEET) = 792.50 DOWNSTREAM (FEET) = 787.80

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)] \*\* 0.20  
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.273  
\* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.636  
SUBAREA Tc AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 0.62 0.20 0.400 91 8.27  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA RUNOFF (CFS) = 2.54  
TOTAL AREA (ACRES) = 0.62 PEAK FLOW RATE (CFS) = 2.54

\*\*\*\*\*  
FLOW PROCESS FROM NODE 5.00 TO NODE 9.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
>>>>(STREET TABLE SECTION # 1 USED)<<<<<<

=====

UPSTREAM ELEVATION (FEET) = 787.80 DOWNSTREAM ELEVATION (FEET) = 780.00  
STREET LENGTH (FEET) = 518.00 CURB HEIGHT (INCHES) = 6.0  
STREET HALFWIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00  
INSIDE STREET CROSSFALL (DECIMAL) = 0.017

OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017

SPECIFIED NUMBER OF HALFSSTREETS CARRYING RUNOFF = 1  
STREET PARKWAY CROSSFALL (DECIMAL) = 0.020  
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150  
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 4.87  
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH (FEET) = 0.36  
HALFSTREET FLOOD WIDTH (FEET) = 13.38  
AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.96  
PRODUCT OF DEPTH\*VELOCITY (FT\*FT/SEC.) = 1.06

STREET FLOW TRAVEL TIME (MIN.) = 2.91 Tc (MIN.) = 11.19  
\* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 3.900  
SUBAREA LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 1.35 0.20 0.400 91  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA AREA (ACRES) = 1.35 SUBAREA RUNOFF (CFS) = 4.64  
EFFECTIVE AREA (ACRES) = 1.97 AREA-AVERAGED Fm (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
TOTAL AREA (ACRES) = 2.0 PEAK FLOW RATE (CFS) = 6.77

END OF SUBAREA STREET FLOW HYDRAULICS:  
DEPTH (FEET) = 0.39 HALFSTREET FLOOD WIDTH (FEET) = 15.31  
FLOW VELOCITY (FEET/SEC.) = 3.20 DEPTH\*VELOCITY (FT\*FT/SEC.) = 1.25  
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 9.00 = 810.00 FEET.

\*\*\*\*\*  
FLOW PROCESS FROM NODE 9.00 TO NODE 9.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<

=====

TOTAL NUMBER OF STREAMS = 2  
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
TIME OF CONCENTRATION (MIN.) = 11.19  
RAINFALL INTENSITY (INCH/HR) = 3.90  
AREA-AVERAGED Fm (INCH/HR) = 0.08  
AREA-AVERAGED Fp (INCH/HR) = 0.20  
AREA-AVERAGED Ap = 0.40  
EFFECTIVE STREAM AREA (ACRES) = 1.97  
TOTAL STREAM AREA (ACRES) = 1.97  
PEAK FLOW RATE (CFS) AT CONFLUENCE = 6.77

\*\*\*\*\*  
FLOW PROCESS FROM NODE 7.00 TO NODE 8.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH (FEET) = 275.00  
ELEVATION DATA: UPSTREAM (FEET) = 792.50 DOWNSTREAM (FEET) = 787.00

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)] \*\* 0.20  
SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 8.273  
\* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.636  
SUBAREA Tc AND LOSS RATE DATA (AMC III):

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)  
RESIDENTIAL  
"8-10 DWELLINGS/ACRE" D 0.62 0.20 0.400 91 8.27  
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400  
SUBAREA RUNOFF (CFS) = 2.54  
TOTAL AREA (ACRES) = 0.62 PEAK FLOW RATE (CFS) = 2.54

\*\*\*\*\*  
FLOW PROCESS FROM NODE 5.00 TO NODE 9.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
>>>>(STREET TABLE SECTION # 1 USED)<<<<<<

=====

UPSTREAM ELEVATION (FEET) = 787.80 DOWNSTREAM ELEVATION (FEET) = 780.00  
STREET LENGTH (FEET) = 518.00 CURB HEIGHT (INCHES) = 6.0  
STREET HALFWIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00  
INSIDE STREET CROSSFALL (DECIMAL) = 0.017



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*****
FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 11.19
RAINFALL INTENSITY(INCH/HR) = 3.90
AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 3.54
TOTAL STREAM AREA(ACRES) = 3.66
PEAK FLOW RATE(CFS) AT CONFLUENCE = 12.63
*****
FLOW PROCESS FROM NODE 12.00 TO NODE 13.00 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 137.00
ELEVATION DATA: UPSTREAM(FEET) = 781.50 DOWNSTREAM(FEET) = 779.00

Tc = K*((LENGTH** 3.00)/(ELEVATION CHANGE))**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.961
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.594
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"8-10 DWELLINGS/ACRE" D 0.25 0.20 0.40 0.40 91 5.96
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400
SUBAREA RUNOFF(CFS) = 1.24
TOTAL AREA(ACRES) = 0.25 PEAK FLOW RATE(CFS) = 1.24
*****
FLOW PROCESS FROM NODE 13.00 TO NODE 14.00 IS CODE = 62
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<
>>>>>(STREET TABLE SECTION # 1 USED)<<<<<<
=====
UPSTREAM ELVATION(FEET) = 779.00 DOWNSTREAM ELEVATION(FEET) = 777.00
STREET LENGTH(FEET) = 246.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 13.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.48
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.33
HALFSTREET FLOOD WIDTH(FEET) = 11.45
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.00
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.65
STREET FLOW TRAVEL TIME(MIN.) = 2.05 Tc(MIN.) = 8.01
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.724
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" D 0.59 0.20 0.40 0.40 91
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.59 SUBAREA RUNOFF(CFS) = 2.47
EFFECTIVE AREA(ACRES) = 0.84 AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 0.8 PEAK FLOW RATE(CFS) = 3.51
*****
END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.36 HALFSTREET FLOOD WIDTH(FEET) = 13.28
FLOW VELOCITY(FEET/SEC.) = 2.17 DEPTH*VELOCITY(FT*FT/SEC.) = 0.77
LONGEST FLOWPATH FROM NODE 12.00 TO NODE 14.00 = 383.00 FEET.
*****
FLOW PROCESS FROM NODE 14.00 TO NODE 14.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.01
RAINFALL INTENSITY(INCH/HR) = 4.72
AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 0.84
TOTAL STREAM AREA(ACRES) = 0.84
PEAK FLOW RATE(CFS) AT CONFLUENCE = 3.51
*****
CONFLUENCE DATA **
STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE
1 12.63 11.19 3.901 0.20( 0.08) 0.40 3.5 7.00
1 12.58 11.89 3.766 0.20( 0.08) 0.40 3.7 4.00
2 3.51 8.01 4.724 0.20( 0.08) 0.40 0.8 12.00
*****
RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR 2 STREAMS.
** PEAK FLOW RATE TABLE **
STREAM Q Tc Intensity Fp(Fm) Ap Ae HEADWATER
NUMBER (CFS) (MIN.) (INCH/HR) (INCH/HR) (ACRES) NODE

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```

1      14.50   8.01   4.724   0.20( 0.08)  0.40   3.4   12.00
2      15.52  11.19   3.901   0.20( 0.08)  0.40   4.4   7.00
3      15.37  11.89   3.766   0.20( 0.08)  0.40   4.5   4.00

```

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

```

PEAK FLOW RATE(CFS) = 15.52 Tc(MIN.) = 11.19
EFFECTIVE AREA(ACRES) = 4.38 AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 4.5
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 14.00 = 1108.00 FEET.

```

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*****
FLOW PROCESS FROM NODE 14.00 TO NODE 41.00 IS CODE = 31

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>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

```

```

=====
ELEVATION DATA: UPSTREAM(FEET) = 777.00 DOWNSTREAM(FEET) = 771.80
FLOW LENGTH(FEET) = 53.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 9.0 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 17.64
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 15.52
PIPE TRAVEL TIME(MIN.) = 0.05 Tc(MIN.) = 11.24
LONGEST FLOWPATH FROM NODE 4.00 TO NODE 41.00 = 1161.00 FEET.

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*****
FLOW PROCESS FROM NODE 41.00 TO NODE 41.00 IS CODE = 10

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>>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<<

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*****
FLOW PROCESS FROM NODE 15.00 TO NODE 16.00 IS CODE = 21

```

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>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<<

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=====
>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
INITIAL SUBAREA FLOW-LENGTH(FEET) = 185.00
ELEVATION DATA: UPSTREAM(FEET) = 785.80 DOWNSTREAM(FEET) = 782.20

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```

Tc = K * [(LENGTH** 3.00) / (ELEVATION CHANGE)]** 0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.394
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.924
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.12 0.20 0.100 91 5.39
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.64 PEAK FLOW RATE(CFS) = 0.64
TOTAL AREA(ACRES) = 0.12

```

```

*****
FLOW PROCESS FROM NODE 16.00 TO NODE 18.00 IS CODE = 62

```

```

>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<
>>>>>(STREET TABLE SECTION # 1 USED)<<<<<<<<

```

```

UPSTREAM ELEVATION(FEET) = 782.20 DOWNSTREAM ELEVATION(FEET) = 780.40
STREET LENGTH(FEET) = 153.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00

```

```

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 13.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017

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SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020

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Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.50

```

STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

```

STREET FLOW DEPTH(FEET) = 0.28
HALFSTREET FLOOD WIDTH(FEET) = 8.50
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.04
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.56
STREET FLOW TRAVEL TIME(MIN.) = 1.25 Tc(MIN.) = 6.64
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.257
SUBAREA LOSS RATE DATA(AMC III):

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```

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE" D 0.37 0.20 0.400 91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.37 SUBAREA RUNOFF(CFS) = 1.72
EFFECTIVE AREA(ACRES) = 0.49 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.33
TOTAL AREA(ACRES) = 0.5 PEAK FLOW RATE(CFS) = 2.29

```

END OF SUBAREA STREET FLOW HYDRAULICS:

```

DEPTH(FEET) = 0.30 HALFSTREET FLOOD WIDTH(FEET) = 10.23
FLOW VELOCITY(FEET/SEC.) = 2.26 DEPTH*VELOCITY(FT*FT/SEC.) = 0.69
LONGEST FLOWPATH FROM NODE 15.00 TO NODE 18.00 = 338.00 FEET.

```

```

*****
FLOW PROCESS FROM NODE 18.00 TO NODE 18.00 IS CODE = 81

```

```

>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<

```

```

MAINLINE Tc(MIN.) = 6.64

```

```

* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.257

```

```

SUBAREA LOSS RATE DATA(AMC III):

```

```

DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"11+ DWELLINGS/ACRE" D 0.44 0.20 0.200 91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200

```

```

SUBAREA RUNOFF(CFS) = 1.93
TOTAL AREA(ACRES) = 0.47 PEAK FLOW RATE(CFS) = 1.93
*****
FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 8.27
RAINFALL INTENSITY(INCH/HR) = 4.64
AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 0.47
TOTAL STREAM AREA(ACRES) = 0.47
PEAK FLOW RATE(CFS) AT CONFLUENCE = 1.93
*****
FLOW PROCESS FROM NODE 20.00 TO NODE 21.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 259.00
ELEVATION DATA: UPSTREAM(FEET) = 787.30 DOWNSTREAM(FEET) = 783.30
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.951
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.743
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE" D 0.56 0.20 0.400 91 7.95
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400
SUBAREA RUNOFF(CFS) = 2.35
TOTAL AREA(ACRES) = 0.56 PEAK FLOW RATE(CFS) = 2.35
*****
FLOW PROCESS FROM NODE 21.00 TO NODE 22.00 IS CODE = 62
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<<<
=====
UPSTREAM ELEVATION(FEET) = 783.30 DOWNSTREAM ELEVATION(FEET) = 777.90
STREET LENGTH(FEET) = 340.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1

```

```

SUBAREA AREA(ACRES) = 0.44 SUBAREA RUNOFF(CFS) = 2.07
EFFECTIVE AREA(ACRES) = 0.93 AREA-AVERAGED Fm(INCH/HR) = 0.05
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.27
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 4.36
*****
FLOW PROCESS FROM NODE 18.00 TO NODE 22.00 IS CODE = 31
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 780.40 DOWNSTREAM(FEET) = 777.90
FLOW LENGTH(FEET) = 153.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 7.3 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.53
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 4.36
PIPE TRAVEL TIME(MIN.) = 0.39 Tc(MIN.) = 7.04
LONGEST FLOWPATH FROM NODE 15.00 TO NODE 22.00 = 491.00 FEET.
*****
FLOW PROCESS FROM NODE 22.00 TO NODE 22.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
=====
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 7.04
RAINFALL INTENSITY(INCH/HR) = 5.09
AREA-AVERAGED Fm(INCH/HR) = 0.05
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.27
EFFECTIVE STREAM AREA(ACRES) = 0.93
TOTAL STREAM AREA(ACRES) = 0.93
PEAK FLOW RATE(CFS) AT CONFLUENCE = 4.36
*****
FLOW PROCESS FROM NODE 19.00 TO NODE 22.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 300.00
ELEVATION DATA: UPSTREAM(FEET) = 783.00 DOWNSTREAM(FEET) = 777.90
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.272
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.637
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL "8-10 DWELLINGS/ACRE" D 0.47 0.20 0.400 91 8.27
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.400

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*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 7.47
RAINFALL INTENSITY(INCH/HR) = 4.92
AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.34
EFFECTIVE STREAM AREA(ACRES) = 2.82
TOTAL STREAM AREA(ACRES) = 3.31
PEAK FLOW RATE(CFS) AT CONFLUENCE = 12.88
*****
FLOW PROCESS FROM NODE 26.00 TO NODE 27.00 IS CODE = 21
>>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 147.00
ELEVATION DATA: UPSTREAM(FEET) = 780.50 DOWNSTREAM(FEET) = 778.30
TC = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM TC(MIN.) = 5.185
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.060
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN
LAND USE
COMMERCIAL D 0.11 0.20 0.100 91 5.19
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
SUBAREA RUNOFF(CFS) = 0.60
TOTAL AREA(ACRES) = 0.11 PEAK FLOW RATE(CFS) = 0.60
*****
FLOW PROCESS FROM NODE 27.00 TO NODE 28.00 IS CODE = 62
>>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>(STREET TABLE SECTION # 1 USED)<<<<<
=====
UPSTREAM ELEVATION(FEET) = 778.30 DOWNSTREAM ELEVATION(FEET) = 774.50
STREET LENGTH(FEET) = 170.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 13.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 1.47
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.25
HALF-STREET FLOOD WIDTH(FEET) = 7.18
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.62
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.66
STREET FLOW TRAVEL TIME(MIN.) = 1.08 Tc(MIN.) = 6.27
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.436
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN
LAND USE
RESIDENTIAL D 0.36 0.20 0.400 91
"8-10 DWELLINGS/ACRE"
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.36 SUBAREA RUNOFF(CFS) = 1.74
EFFECTIVE AREA(ACRES) = 0.47 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.33
TOTAL AREA(ACRES) = 0.5 PEAK FLOW RATE(CFS) = 2.27
END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.28 HALF-STREET FLOOD WIDTH(FEET) = 8.81
FLOW VELOCITY(FEET/SEC.) = 2.91 DEPTH*VELOCITY(FT*FT/SEC.) = 0.82
LONGEST FLOWPATH FROM NODE 26.00 TO NODE 28.00 = 317.00 FEET.
*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 81
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
=====
MAINLINE Tc(MIN.) = 6.27
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.436
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp (INCH/HR) Ap (DECIMAL) CN
LAND USE
RESIDENTIAL D 0.47 0.20 0.400 91
"8-10 DWELLINGS/ACRE"
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 0.47 SUBAREA RUNOFF(CFS) = 2.27
EFFECTIVE AREA(ACRES) = 0.94 AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.36
TOTAL AREA(ACRES) = 0.9 PEAK FLOW RATE(CFS) = 4.54
*****
FLOW PROCESS FROM NODE 28.00 TO NODE 28.00 IS CODE = 1
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.27
RAINFALL INTENSITY(INCH/HR) = 5.44
AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20

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RAINFALL INTENSITY (INCH/HR) = 4.88  
 AREA-AVERAGED Fp (INCH/HR) = 0.07  
 AREA-AVERAGED Fm (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.35  
 EFFECTIVE STREAM AREA (ACRES) = 3.76  
 TOTAL STREAM AREA (ACRES) = 4.25  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 16.98

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.10 TO NODE 28.20 IS CODE = 21  
 >>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<<  
 >>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<<

INITIAL SUBAREA FLOW-LENGTH (FEET) = 265.00  
 ELEVATION DATA: UPSTREAM (FEET) = 779.50 DOWNSTREAM (FEET) = 774.80

Tc = K \* [(LENGTH\*\* 3.00) / (ELEVATION CHANGE)] \*\* 0.20  
 SUBAREA ANALYSIS USED MINIMUM Tc (MIN.) = 7.805  
 \* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.794  
 SUBAREA Tc AND LOSS RATE DATA (AMC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc  
 LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)  
 RESIDENTIAL  
 "8-10 DWELLINGS/ACRE" D 0.55 0.20 0.400 91 7.81  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400  
 SUBAREA RUNOFF (CFS) = 2.33  
 TOTAL AREA (ACRES) = 0.55 PEAK FLOW RATE (CFS) = 2.33

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.20 TO NODE 29.00 IS CODE = 62

>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
 >>>>(STREET TABLE SECTION # 1 USED)<<<<<<

UPSTREAM ELEVATION (FEET) = 774.80 DOWNSTREAM ELEVATION (FEET) = 774.30  
 STREET LENGTH (FEET) = 62.00 CURB HEIGHT (INCHES) = 6.0  
 STREET HALFWIDTH (FEET) = 18.00

DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK (FEET) = 13.00  
 INSIDE STREET CROSSFALL (DECIMAL) = 0.017  
 OUTSIDE STREET CROSSFALL (DECIMAL) = 0.017

SPECIFIED NUMBER OF HALF-STREETS CARRYING RUNOFF = 1  
 STREET PARKWAY CROSSFALL (DECIMAL) = 0.020  
 Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150  
 Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200

\*\*TRAVEL TIME COMPUTED USING ESTIMATED FLOW (CFS) = 3.15  
 STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:  
 STREET FLOW DEPTH (FEET) = 0.35  
 HALF-STREET FLOOD WIDTH (FEET) = 12.77  
 AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.09  
 PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.73  
 STREET FLOW TRAVEL TIME (MIN.) = 0.49 Tc (MIN.) = 8.30

AREA-AVERAGED Ap = 0.36  
 EFFECTIVE STREAM AREA (ACRES) = 0.94  
 TOTAL STREAM AREA (ACRES) = 0.94  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 4.54

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	12.45	6.55	5.300	0.20 (0.07)	0.34	2.5	23.00
1	12.88	7.47	4.916	0.20 (0.07)	0.34	2.8	15.00
1	12.74	8.71	4.503	0.20 (0.07)	0.35	3.1	19.00
1	12.34	10.38	4.071	0.20 (0.07)	0.35	3.3	20.00
2	4.54	6.27	5.436	0.20 (0.07)	0.36	0.9	26.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	16.76	6.27	5.436	0.20 (0.07)	0.35	3.4	26.00
2	16.88	6.55	5.300	0.20 (0.07)	0.35	3.5	23.00
3	16.98	7.47	4.916	0.20 (0.07)	0.35	3.8	15.00
4	16.49	8.71	4.503	0.20 (0.07)	0.35	4.0	19.00
5	15.72	10.38	4.071	0.20 (0.07)	0.36	4.2	20.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
 PEAK FLOW RATE (CFS) = 16.98 Tc (MIN.) = 7.47  
 EFFECTIVE AREA (ACRES) = 3.76 AREA-AVERAGED Fm (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 4.2  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 28.00 = 816.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 28.00 TO NODE 29.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

ELEVATION DATA: UPSTREAM (FEET) = 774.50 DOWNSTREAM (FEET) = 774.30  
 FLOW LENGTH (FEET) = 36.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 27.0 INCH PIPE IS 17.9 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 6.08  
 ESTIMATED PIPE DIAMETER (INCH) = 27.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 16.98  
 PIPE TRAVEL TIME (MIN.) = 0.10 Tc (MIN.) = 7.57  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 29.00 = 852.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 29.00 TO NODE 29.00 IS CODE = 1  
 >>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<

\*\*\*\*\*  
 TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:  
 TIME OF CONCENTRATION (MIN.) = 7.57





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ELEVATION DATA: UPSTREAM(FEET) = 773.70  DOWNSTREAM(FEET) = 772.30
FLOW LENGTH(FEET) = 277.00  MANNING'S N = 0.013
DEPTH OF FLOW IN 30.0 INCH PIPE IS 22.2 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.37
ESTIMATED PIPE DIAMETER(INCH) = 30.00  NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 24.77
PIPE TRAVEL TIME(MIN.) = 0.72  Tc(MIN.) = 8.62
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 38.00 = 1252.00 FEET.
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*****
FLOW PROCESS FROM NODE 38.00 TO NODE 38.00 IS CODE = 10
>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 2 <<<<
=====
*****
FLOW PROCESS FROM NODE 33.00 TO NODE 34.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
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INITIAL SUBAREA FLOW-LENGTH(FEET) = 266.00
ELEVATION DATA: UPSTREAM(FEET) = 788.00  DOWNSTREAM(FEET) = 784.30

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Tc = K*{(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 8.207
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.658
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/  SCS SOIL  AREA  Fp  Ap  SCS  Tc
LAND USE          GROUP  (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"8-10 DWELLINGS/ACRE"  D  0.53  0.20  0.400  91  8.21
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA RUNOFF(CFS) = 2.18
TOTAL AREA(ACRES) = 0.53  PEAK FLOW RATE(CFS) = 2.18
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*****
FLOW PROCESS FROM NODE 34.00 TO NODE 37.00 IS CODE = 62
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 2 USED)<<<<
=====
UPSTREAM ELEVATION(FEET) = 784.30  DOWNSTREAM ELEVATION(FEET) = 777.60
STREET LENGTH(FEET) = 623.00  CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 16.00
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DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 11.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSIDEWAYS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section (curb-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
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**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 4.01
STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
STREET FLOW DEPTH(FEET) = 0.36
HALF-STREET FLOOD WIDTH(FEET) = 13.29
AVERAGE FLOW VELOCITY(FEET/SEC.) = 2.47
PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) = 0.88
STREET FLOW TRAVEL TIME(MIN.) = 4.21  Tc(MIN.) = 12.41
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.675
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/  SCS SOIL  AREA  Fp  Ap  SCS
LAND USE          GROUP  (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
"8-10 DWELLINGS/ACRE"  D  1.12  0.20  0.400  91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 1.12  SUBAREA RUNOFF(CFS) = 3.62
EFFECTIVE AREA(ACRES) = 1.65  AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 1.6  PEAK FLOW RATE(CFS) = 5.34
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END OF SUBAREA STREET FLOW HYDRAULICS:
DEPTH(FEET) = 0.38  HALF-STREET FLOOD WIDTH(FEET) = 14.93
FLOW VELOCITY(FEET/SEC.) = 2.65  DEPTH*VELOCITY(FT*FT/SEC.) = 1.02
LONGEST FLOWPATH FROM NODE 33.00 TO NODE 37.00 = 889.00 FEET.
*****
FLOW PROCESS FROM NODE 37.00 TO NODE 37.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 12.41
RAINFALL INTENSITY(INCH/HR) = 3.67
AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.40
EFFECTIVE STREAM AREA(ACRES) = 1.65
TOTAL STREAM AREA(ACRES) = 1.65
PEAK FLOW RATE(CFS) AT CONFLUENCE = 5.34
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*****
FLOW PROCESS FROM NODE 36.00 TO NODE 37.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
ELEVATION DATA: UPSTREAM(FEET) = 778.70  DOWNSTREAM(FEET) = 777.60
Tc = K*{(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/  SCS SOIL  AREA  Fp  Ap  SCS  Tc
LAND USE          GROUP  (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"8-10 DWELLINGS/ACRE"  D  1.12  0.20  0.400  91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 1.12  SUBAREA RUNOFF(CFS) = 3.62
EFFECTIVE AREA(ACRES) = 1.65  AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 1.6  PEAK FLOW RATE(CFS) = 5.34
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*****
FLOW PROCESS FROM NODE 36.00 TO NODE 37.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(FEET) = 100.00
ELEVATION DATA: UPSTREAM(FEET) = 778.70  DOWNSTREAM(FEET) = 777.60
Tc = K*{(LENGTH** 3.00)/(ELEVATION CHANGE)**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 5.000
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 6.187
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/  SCS SOIL  AREA  Fp  Ap  SCS  Tc
LAND USE          GROUP  (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
"8-10 DWELLINGS/ACRE"  D  1.12  0.20  0.400  91
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.400
SUBAREA AREA(ACRES) = 1.12  SUBAREA RUNOFF(CFS) = 3.62
EFFECTIVE AREA(ACRES) = 1.65  AREA-AVERAGED Fm(INCH/HR) = 0.08
AREA-AVERAGED Fp(INCH/HR) = 0.20  AREA-AVERAGED Ap = 0.40
TOTAL AREA(ACRES) = 1.6  PEAK FLOW RATE(CFS) = 5.34
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LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)  
 COMMERCIAL D 0.18 0.20 0.100 91 5.00  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100  
 SUBAREA RUNOFF (CFS) = 1.00 PEAK FLOW RATE (CFS) = 1.00  
 TOTAL AREA (ACRES) = 0.18

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 37.00 TO NODE 37.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<<  
 >>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<<<

TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
 TIME OF CONCENTRATION (MIN.) = 5.00  
 RAINFALL INTENSITY (INCH/HR) = 6.19  
 AREA-AVERAGED Fp (INCH/HR) = 0.02  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.10  
 EFFECTIVE STREAM AREA (ACRES) = 0.18  
 TOTAL STREAM AREA (ACRES) = 0.18  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 1.00

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	5.34	12.41	3.675	0.20 (0.08)	0.40	1.6	33.00
2	1.00	5.00	6.187	0.20 (0.02)	0.10	0.2	36.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	4.65	5.00	6.187	0.20 (0.07)	0.34	0.8	36.00
2	5.93	12.41	3.675	0.20 (0.07)	0.37	1.8	33.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
 PEAK FLOW RATE (CFS) = 5.93 Tc (MIN.) = 12.41  
 EFFECTIVE AREA (ACRES) = 1.83 AREA-AVERAGED Fp (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.37  
 TOTAL AREA (ACRES) = 1.8  
 LONGEST FLOWPATH FROM NODE 33.00 TO NODE 37.00 = 889.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 37.00 TO NODE 38.00 IS CODE = 31

>>>> COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA <<<<<<  
 >>>> USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW) <<<<<<

ELEVATION DATA: UPSTREAM (FEET) = 777.60 DOWNSTREAM (FEET) = 772.30  
 FLOW LENGTH (FEET) = 49.00 MANNING'S N = 0.013  
 ESTIMATED PIPE DIAMETER (INCH) INCREASED TO 18.000  
 DEPTH OF FLOW IN 18.0 INCH PIPE IS 5.2 INCHES

PIPE-FLOW VELOCITY (FEET/SEC.) = 14.08  
 ESTIMATED PIPE DIAMETER (INCH) = 18.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 5.93  
 PIPE TRAVEL TIME (MIN.) = 0.06 Tc (MIN.) = 12.47  
 LONGEST FLOWPATH FROM NODE 33.00 TO NODE 38.00 = 938.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 38.00 TO NODE 38.00 IS CODE = 11

>>>> CONFLUENCE MEMORY BANK # 2 WITH THE MAIN-STREAM MEMORY <<<<<<

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	4.65	5.06	6.144	0.20 (0.07)	0.34	0.8	36.00
2	5.93	12.47	3.665	0.20 (0.07)	0.37	1.8	33.00

\*\* MEMORY BANK # 2 CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	24.29	7.42	4.933	0.20 (0.07)	0.34	4.9	26.00
2	24.42	7.56	4.882	0.20 (0.07)	0.34	5.0	30.00
3	24.50	7.71	4.829	0.20 (0.07)	0.34	5.1	23.00
4	24.77	8.62	4.528	0.20 (0.07)	0.34	5.6	15.00
5	24.62	9.36	4.321	0.20 (0.07)	0.35	5.8	28.10
6	24.16	9.86	4.192	0.20 (0.07)	0.35	5.9	19.00
7	22.65	11.55	3.829	0.20 (0.07)	0.35	6.2	20.00

LONGEST FLOWPATH FROM NODE 20.00 TO NODE 38.00 = 1252.00 FEET.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	25.34	5.06	6.144	0.20 (0.07)	0.34	4.2	36.00
2	29.35	7.42	4.933	0.20 (0.07)	0.34	6.1	26.00
3	29.50	7.56	4.882	0.20 (0.07)	0.34	6.2	30.00
4	29.61	7.71	4.829	0.20 (0.07)	0.34	6.3	23.00
5	30.04	8.62	4.528	0.20 (0.07)	0.34	6.9	15.00
6	30.02	9.36	4.321	0.20 (0.07)	0.35	7.3	28.10
7	29.64	9.86	4.192	0.20 (0.07)	0.35	7.4	19.00
8	28.43	11.55	3.829	0.20 (0.07)	0.35	7.9	20.00
9	27.59	12.47	3.665	0.20 (0.07)	0.35	8.0	33.00

TOTAL AREA (ACRES) = 8.0

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:  
 PEAK FLOW RATE (CFS) = 30.04 Tc (MIN.) = 8.622  
 EFFECTIVE AREA (ACRES) = 6.88 AREA-AVERAGED Fp (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 8.0  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 38.00 = 1252.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 38.00 TO NODE 38.00 IS CODE = 12  
 >>>> CLEAR MEMORY BANK # 2 <<<<<<

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*****
FLOW PROCESS FROM NODE 38.00 TO NODE 40.00 IS CODE = 31
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<
ELEVATION DATA: UPSTREAM(FEET) = 772.30 DOWNSTREAM(FEET) = 772.00
FLOW LENGTH(FEET) = 65.00 MANNING'S N = 0.013
DEPTH OF FLOW IN 33.0 INCH PIPE IS 24.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 6.48
ESTIMATED PIPE DIAMETER(INCH) = 33.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 30.04
PIPE TRAVEL TIME(MIN.) = 0.17 Tc(MIN.) = 8.79
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 40.00 = 1317.00 FEET.
*****
FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 8.79
RAINFALL INTENSITY(INCH/HR) = 4.48
AREA-AVERAGED Fm(INCH/HR) = 0.07
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.34
EFFECTIVE STREAM AREA(ACRES) = 6.88
TOTAL STREAM AREA(ACRES) = 8.01
PEAK FLOW RATE(CFS) AT CONFLUENCE = 30.04
*****
FLOW PROCESS FROM NODE 39.00 TO NODE 40.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
INITIAL SUBAREA FLOW-LENGTH(FEET) = 200.00
ELEVATION DATA: UPSTREAM(FEET) = 778.00 DOWNSTREAM(FEET) = 776.00
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.357
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 5.392
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
COMMERCIAL D 0.18 0.20 0.100 91 6.36
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.100
TOTAL AREA(ACRES) = 0.18 PEAK FLOW RATE(CFS) = 0.87
*****
FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1

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>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
TOTAL NUMBER OF STREAMS = 3
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION(MIN.) = 6.36
RAINFALL INTENSITY(INCH/HR) = 5.39
AREA-AVERAGED Fm(INCH/HR) = 0.02
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.10
EFFECTIVE STREAM AREA(ACRES) = 0.18
TOTAL STREAM AREA(ACRES) = 0.18
PEAK FLOW RATE(CFS) AT CONFLUENCE = 0.87
*****
FLOW PROCESS FROM NODE 39.10 TO NODE 39.20 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
INITIAL SUBAREA FLOW-LENGTH(FEET) = 283.00
ELEVATION DATA: UPSTREAM(FEET) = 781.00 DOWNSTREAM(FEET) = 777.70
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 7.549
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 4.886
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL D 0.31 0.20 0.200 91 7.55
SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200
SUBAREA RUNOFF(CFS) = 1.35
TOTAL AREA(ACRES) = 0.31 PEAK FLOW RATE(CFS) = 1.35
*****
FLOW PROCESS FROM NODE 39.20 TO NODE 40.00 IS CODE = 62
>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>(STREET TABLE SECTION # 1 USED)<<<<
UPSTREAM ELEVATION(FEET) = 777.70 DOWNSTREAM ELEVATION(FEET) = 776.00
STREET LENGTH(FEET) = 125.00 CURB HEIGHT(INCHES) = 6.0
STREET HALFWIDTH(FEET) = 18.00
DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) = 13.00
INSIDE STREET CROSSFALL(DECIMAL) = 0.017
OUTSIDE STREET CROSSFALL(DECIMAL) = 0.017
SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF = 1
STREET PARKWAY CROSSFALL(DECIMAL) = 0.020
Manning's FRICTION FACTOR for Streetflow Section(curbs-to-curb) = 0.0150
Manning's FRICTION FACTOR for Back-of-Walk Flow Section = 0.0200
**TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.63

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STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:

STREET FLOW DEPTH (FEET) = 0.31  
 HALFSURET FLOOD WIDTH (FEET) = 10.54  
 AVERAGE FLOW VELOCITY (FEET/SEC.) = 2.47  
 PRODUCT OF DEPTH&VELOCITY (FT\*FT/SEC.) = 0.76  
 STREET FLOW TRAVEL TIME (MIN.) = 0.84 Tc (MIN.) = 8.39  
 \* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.598  
 SUBAREA LOSS RATE DATA (AWC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 GROUP (ACRES) (INCH/HR) (DECIMAL) CN  
 RESIDENTIAL  
 \*5-7 DWELLINGS/ACRE\* D 0.63 0.20 0.500 91  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.500  
 SUBAREA AREA (ACRES) = 0.63 SUBAREA RUNOFF (CFS) = 2.55  
 EFFECTIVE AREA (ACRES) = 0.94 AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.40  
 TOTAL AREA (ACRES) = 0.9 PEAK FLOW RATE (CFS) = 3.82

END OF SUBAREA STREET FLOW HYDRAULICS:

DEPTH (FEET) = 0.34 HALFSURET FLOOD WIDTH (FEET) = 12.36  
 FLOW VELOCITY (FEET/SEC.) = 2.69 DEPTH\*VELOCITY (FT\*FT/SEC.) = 0.92  
 LONGEST FLOWPATH FROM NODE 39.10 TO NODE 40.00 = 408.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 40.00 TO NODE 40.00 IS CODE = 1

>>>> DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE <<<<<<

>>>> AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES <<<<<<

=====

TOTAL NUMBER OF STREAMS = 3

CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 3 ARE:

TIME OF CONCENTRATION (MIN.) = 8.39  
 RAINFALL INTENSITY (INCH/HR) = 4.60  
 AREA-AVERAGED Fm (INCH/HR) = 0.08  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.40  
 EFFECTIVE STREAM AREA (ACRES) = 0.94  
 TOTAL STREAM AREA (ACRES) = 0.94  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 3.82

\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	25.34	5.24	6.024	0.20 (0.07)	0.34	4.2	36.00
1	29.35	7.59	4.871	0.20 (0.07)	0.34	6.1	26.00
1	29.50	7.73	4.821	0.20 (0.07)	0.34	6.2	30.00
1	29.61	7.87	4.770	0.20 (0.07)	0.34	6.3	23.00
1	30.04	8.79	4.478	0.20 (0.07)	0.34	6.9	15.00
1	30.02	9.52	4.277	0.20 (0.07)	0.35	7.3	28.10
1	29.64	10.03	4.152	0.20 (0.07)	0.35	7.4	19.00
1	28.43	11.72	3.797	0.20 (0.07)	0.35	7.9	20.00
1	27.59	12.64	3.636	0.20 (0.07)	0.35	8.0	33.00
2	0.87	6.36	5.392	0.20 (0.02)	0.10	0.2	39.00
3	3.82	8.39	4.598	0.20 (0.08)	0.40	0.9	39.10

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO CONFLUENCE FORMULA USED FOR 3 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	29.28	5.24	6.024	0.20 (0.07)	0.34	4.9	36.00
2	31.52	6.36	5.392	0.20 (0.07)	0.34	6.0	39.00
3	33.80	7.59	4.871	0.20 (0.07)	0.34	7.1	26.00
4	33.97	7.73	4.821	0.20 (0.07)	0.34	7.2	30.00
5	34.10	7.87	4.770	0.20 (0.07)	0.34	7.3	23.00
6	34.42	8.39	4.598	0.20 (0.07)	0.34	7.7	39.10
7	34.48	8.79	4.478	0.20 (0.07)	0.35	8.0	15.00
8	34.26	9.52	4.277	0.20 (0.07)	0.35	8.4	28.10
9	33.75	10.03	4.152	0.20 (0.07)	0.35	8.5	19.00
10	32.18	11.72	3.797	0.20 (0.07)	0.35	9.0	20.00
11	31.19	12.64	3.636	0.20 (0.07)	0.35	9.1	33.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 34.48 Tc (MIN.) = 8.79  
 EFFECTIVE AREA (ACRES) = 8.00 AREA-AVERAGED Fm (INCH/HR) = 0.07  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.35  
 TOTAL AREA (ACRES) = 9.1  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 40.00 = 1317.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 40.00 TO NODE 41.00 IS CODE = 31

>>>> COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA <<<<<<

>>>> USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW) <<<<<<

=====

ELEVATION DATA: UPSTREAM (FEET) = 772.00 DOWNSTREAM (FEET) = 771.80  
 FLOW LENGTH (FEET) = 38.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 33.0 INCH PIPE IS 25.6 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 6.97  
 ESTIMATED PIPE DIAMETER (INCH) = 33.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 34.48  
 PIPE TRAVEL TIME (MIN.) = 0.09 Tc (MIN.) = 8.88  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 41.00 = 1355.00 FEET.

\*\*\*\*\*

FLOW PROCESS FROM NODE 41.00 TO NODE 41.00 IS CODE = 11

>>>> CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY <<<<<<

=====

\*\* MAIN STREAM CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	29.28	5.33	5.964	0.20 (0.07)	0.34	4.9	36.00
2	31.52	6.45	5.348	0.20 (0.07)	0.34	6.0	39.00
3	33.80	7.68	4.838	0.20 (0.07)	0.34	7.1	26.00
4	33.97	7.82	4.788	0.20 (0.07)	0.34	7.2	30.00
5	34.10	7.96	4.739	0.20 (0.07)	0.34	7.3	23.00
6	34.42	8.48	4.570	0.20 (0.07)	0.34	7.7	39.10
7	34.48	8.88	4.452	0.20 (0.07)	0.35	8.0	15.00



PIPE TRAVEL TIME (MIN.) = 1.28 Tc (MIN.) = 9.03  
 LONGEST FLOWPATH FROM NODE 43.00 TO NODE 45.00 = 680.00 FEET.  
 \*\*\*\*\*  
 FLOW PROCESS FROM NODE 45.00 TO NODE 45.00 IS CODE = 81  
 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<<  
 =====  
 MAINLINE Tc (MIN.) = 9.03  
 \* 100 YEAR RAINFALL INTENSITY (INCH/HR) = 4.409  
 SUBAREA LOSS RATE DATA (AMC III):  
 DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS  
 LAND USE (ACRES) (INCH/HR) (DECIMAL) CN  
 RESIDENTIAL  
 \*11+ DWELLINGS/ACRE" D 8.22 0.20 0.200 91  
 SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.200  
 SUBAREA AREA (ACRES) = 8.22 SUBAREA RUNOFF (CFS) = 32.32  
 EFFECTIVE AREA (ACRES) = 9.07 AREA-AVERAGED Fm (INCH/HR) = 0.04  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.20  
 TOTAL AREA (ACRES) = 9.1 PEAK FLOW RATE (CFS) = 35.66

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 45.00 TO NODE 46.00 IS CODE = 31  
 >>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<  
 =====  
 ELEVATION DATA: UPSTREAM (FEET) = 770.00 DOWNSTREAM (FEET) = 768.80  
 FLOW LENGTH (FEET) = 232.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 33.0 INCH PIPE IS 26.7 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 6.92  
 ESTIMATED PIPE DIAMETER (INCH) = 33.00 NUMBER OF PIPES = 1  
 PIPE-FLOW (CFS) = 35.66  
 PIPE TRAVEL TIME (MIN.) = 0.56 Tc (MIN.) = 9.59  
 LONGEST FLOWPATH FROM NODE 43.00 TO NODE 46.00 = 912.00 FEET.  
 \*\*\*\*\*  
 FLOW PROCESS FROM NODE 46.00 TO NODE 46.00 IS CODE = 1

>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<  
 >>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<  
 =====  
 TOTAL NUMBER OF STREAMS = 2  
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:  
 TIME OF CONCENTRATION (MIN.) = 9.59  
 RAINFALL INTENSITY (INCH/HR) = 4.26  
 AREA-AVERAGED Fm (INCH/HR) = 0.04  
 AREA-AVERAGED Fp (INCH/HR) = 0.20  
 AREA-AVERAGED Ap = 0.20  
 EFFECTIVE STREAM AREA (ACRES) = 9.07  
 TOTAL STREAM AREA (ACRES) = 9.07  
 PEAK FLOW RATE (CFS) AT CONFLUENCE = 35.66  
 \*\*\*\*\*  
 \*\* CONFLUENCE DATA \*\*  
 STREAM Q Tc Intensity Fp (Fm) Ap Ae HEADWATER

NUMBER	(CFS)	(MIN.)	(INCH/HR)	(INCH/HR)	(ACRES)	NODE
1	41.48	5.93	5.609	0.20	0.07	36.00
1	44.73	7.04	5.084	0.20	0.07	39.00
1	48.02	8.26	4.641	0.20	0.07	26.00
1	48.29	8.40	4.598	0.20	0.07	30.00
1	48.53	8.54	4.553	0.20	0.07	23.00
1	48.66	8.63	4.525	0.20	0.07	12.00
1	49.05	9.06	4.402	0.20	0.07	39.10
1	49.25	9.45	4.295	0.20	0.07	15.00
1	49.25	10.19	4.115	0.20	0.07	28.10
1	48.91	10.70	4.002	0.20	0.07	19.00
1	48.24	11.81	3.781	0.20	0.07	7.00
1	47.58	12.41	3.676	0.20	0.07	13.5
1	47.41	12.54	3.654	0.20	0.07	4.00
1	45.99	13.33	3.528	0.20	0.07	33.00
2	35.66	9.59	4.260	0.20	0.04	43.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
 CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap (ACRES)	Ae (ACRES)	HEADWATER NODE
1	70.59	5.93	5.609	0.20	0.06	12.8	36.00
2	76.04	7.04	5.084	0.20	0.06	15.3	39.00
3	81.50	8.26	4.641	0.20	0.06	18.1	26.00
4	82.00	8.40	4.598	0.20	0.06	18.4	30.00
5	82.48	8.54	4.553	0.20	0.06	18.8	23.00
6	82.77	8.63	4.525	0.20	0.06	19.0	12.00
7	83.87	9.06	4.402	0.20	0.06	19.8	39.10
8	84.69	9.45	4.295	0.20	0.06	20.6	15.00
9	84.91	9.59	4.260	0.20	0.06	20.8	43.00
10	83.70	10.19	4.115	0.20	0.06	21.3	28.10
11	82.39	10.70	4.002	0.20	0.06	21.6	19.00
12	79.85	11.81	3.781	0.20	0.06	22.3	7.00
13	78.30	12.41	3.676	0.20	0.06	22.6	20.00
14	77.95	12.54	3.654	0.20	0.06	22.6	4.00
15	75.47	13.33	3.528	0.20	0.06	22.7	33.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE (CFS) = 84.91 Tc (MIN.) = 9.59  
 EFFECTIVE AREA (ACRES) = 20.81 AREA-AVERAGED Fm (INCH/HR) = 0.06  
 AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.29  
 TOTAL AREA (ACRES) = 22.7  
 LONGEST FLOWPATH FROM NODE 20.00 TO NODE 46.00 = 1683.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 46.00 TO NODE 50.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<<  
 >>>>USING COMPUTER-ESTIMATED PIPE SIZE (NON-PRESSURE FLOW)<<<<<<

=====  
 ELEVATION DATA: UPSTREAM (FEET) = 768.80 DOWNSTREAM (FEET) = 760.00  
 FLOW LENGTH (FEET) = 55.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 24.0 INCH PIPE IS 19.4 INCHES  
 PIPE-FLOW VELOCITY (FEET/SEC.) = 31.15

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ESTIMATED PIPE DIAMETER(INCH) = 24.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 84.91
PIPE TRAVEL TIME(MIN.) = 0.03 Tc(MIN.) = 9.62
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 50.00 = 1738.00 FEET.
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 1
>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 1 ARE:
TIME OF CONCENTRATION(MIN.) = 9.62
RAINFALL INTENSITY(INCH/HR) = 4.25
AREA-AVERAGED Fp(INCH/HR) = 0.06
AREA-AVERAGED Fp(INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.29
EFFECTIVE STREAM AREA(ACRES) = 20.81
TOTAL STREAM AREA(ACRES) = 22.70
PEAK FLOW RATE(CFS) AT CONFLUENCE = 84.91
*****
FLOW PROCESS FROM NODE 47.00 TO NODE 48.00 IS CODE = 21
>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<
>>>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<
=====
INITIAL SUBAREA FLOW-LENGTH(PEET) = 300.00
ELEVATION DATA: UPSTREAM(FEET) = 792.50 DOWNSTREAM(FEET) = 788.50
Tc = K*[(LENGTH** 3.00)/(ELEVATION CHANGE)]**0.20
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 11.308
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.876
SUBAREA Tc AND LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS Tc
LAND USE (ACRES) (INCH/HR) (DECIMAL) CN (MIN.)
RESIDENTIAL
".4 DWELLING/ACRE" D 0.12 0.20 0.90 91 11.31
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.90
SUBAREA RUNOFF(CFS) = 0.40
TOTAL AREA(ACRES) = 0.12 PEAK FLOW RATE(CFS) = 0.40
*****
FLOW PROCESS FROM NODE 48.00 TO NODE 49.00 IS CODE = 51
>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT) <<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 788.50 DOWNSTREAM(FEET) = 774.00
CHANNEL LENGTH THRU SUBAREA(FEET) = 1050.00 CHANNEL SLOPE = 0.0138
CHANNEL BASE(FEET) = 0.00 "Z" FACTOR = 2.000
MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 1.00
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.256
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
".4 DWELLING/ACRE" D 1.76 0.20 0.90 91
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.90
SUBAREA AREA(ACRES) = 1.76 SUBAREA RUNOFF(CFS) = 4.86
EFFECTIVE AREA(ACRES) = 3.16 AREA-AVERAGED Fp(INCH/HR) = 0.18
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 3.2 PEAK FLOW RATE(CFS) = 8.72
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 1

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LAND USE GROUP (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
".4 DWELLING/ACRE" D 1.28 0.20 0.90 91
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.90
TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 2.18
TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 4.35
AVERAGE FLOW DEPTH(FEET) = 0.50 TRAVEL TIME(MIN.) = 4.03
Tc(MIN.) = 15.33
SUBAREA AREA(ACRES) = 1.28 SUBAREA RUNOFF(CFS) = 3.54
EFFECTIVE AREA(ACRES) = 1.40 AREA-AVERAGED Fp(INCH/HR) = 0.18
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 1.4 PEAK FLOW RATE(CFS) = 3.88
END OF SUBAREA CHANNEL FLOW HYDRAULICS:
DEPTH(FEET) = 0.62 FLOW VELOCITY(FEET/SEC.) = 5.00
LONGEST FLOWPATH FROM NODE 47.00 TO NODE 49.00 = 1350.00 FEET.
*****
FLOW PROCESS FROM NODE 49.00 TO NODE 50.00 IS CODE = 31
>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<
>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<
=====
ELEVATION DATA: UPSTREAM(FEET) = 774.00 DOWNSTREAM(FEET) = 760.00
FLOW LENGTH(FEET) = 65.00 MANNING'S N = 0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN 18.0 INCH PIPE IS 3.5 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) = 15.88
ESTIMATED PIPE DIAMETER(INCH) = 18.00 NUMBER OF PIPES = 1
PIPE-FLOW(CFS) = 3.88
PIPE TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 15.40
LONGEST FLOWPATH FROM NODE 47.00 TO NODE 50.00 = 1415.00 FEET.
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 81
>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====
MAINLINE Tc(MIN.) = 15.40
* 100 YEAR RAINFALL INTENSITY(INCH/HR) = 3.247
SUBAREA LOSS RATE DATA(AMC III):
DEVELOPMENT TYPE/ SCS SOIL AREA Fp Ap SCS
LAND USE (ACRES) (INCH/HR) (DECIMAL) CN
RESIDENTIAL
".4 DWELLING/ACRE" D 1.76 0.20 0.90 91
SUBAREA AVERAGE PVIOUS LOSS RATE, Fp(INCH/HR) = 0.20
SUBAREA AVERAGE PVIOUS AREA FRACTION, Ap = 0.90
SUBAREA AREA(ACRES) = 1.76 SUBAREA RUNOFF(CFS) = 4.86
EFFECTIVE AREA(ACRES) = 3.16 AREA-AVERAGED Fp(INCH/HR) = 0.18
AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.90
TOTAL AREA(ACRES) = 3.2 PEAK FLOW RATE(CFS) = 8.72
*****
FLOW PROCESS FROM NODE 50.00 TO NODE 50.00 IS CODE = 1

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>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<<
=====
TOTAL NUMBER OF STREAMS = 2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM 2 ARE:
TIME OF CONCENTRATION (MIN.) = 15.40
RAINFALL INTENSITY (INCH/HR) = 3.25
AREA-AVERAGED Fp (INCH/HR) = 0.18
AREA-AVERAGED Fp (INCH/HR) = 0.20
AREA-AVERAGED Ap = 0.90
EFFECTIVE STREAM AREA (ACRES) = 3.16
TOTAL STREAM AREA (ACRES) = 3.16
PEAK FLOW RATE (CFS) AT CONFLUENCE = 8.72

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\*\* CONFLUENCE DATA \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	70.59	5.96	5.593	0.20(0.06)	0.29	12.8	36.00
1	76.04	7.07	5.071	0.20(0.06)	0.29	15.3	39.00
1	81.50	8.29	4.632	0.20(0.06)	0.29	18.1	26.00
1	82.00	8.42	4.588	0.20(0.06)	0.29	18.4	30.00
1	82.48	8.57	4.544	0.20(0.06)	0.29	18.8	23.00
1	82.77	8.66	4.516	0.20(0.06)	0.29	19.0	12.00
1	83.87	9.09	4.394	0.20(0.06)	0.29	19.8	39.10
1	84.69	9.48	4.288	0.20(0.06)	0.29	20.6	15.00
1	84.91	9.62	4.252	0.20(0.06)	0.29	20.8	43.00
1	83.70	10.22	4.109	0.20(0.06)	0.29	21.3	28.10
1	82.39	10.73	3.995	0.20(0.06)	0.30	21.6	19.00
1	79.85	11.84	3.775	0.20(0.06)	0.30	22.3	7.00
1	78.30	12.44	3.671	0.20(0.06)	0.30	22.6	20.00
1	77.95	12.57	3.649	0.20(0.06)	0.30	22.6	4.00
1	75.47	13.36	3.523	0.20(0.06)	0.30	22.7	33.00
2	8.72	15.40	3.247	0.20(0.18)	0.90	3.2	47.00

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO  
CONFLUENCE FORMULA USED FOR 2 STREAMS.

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	76.55	5.96	5.593	0.20(0.07)	0.34	14.0	36.00
2	82.43	7.07	5.071	0.20(0.07)	0.34	16.8	39.00
3	88.31	8.29	4.632	0.20(0.07)	0.34	19.8	26.00
4	88.86	8.42	4.588	0.20(0.07)	0.34	20.2	30.00
5	89.39	8.57	4.544	0.20(0.07)	0.34	20.5	23.00
6	89.71	8.66	4.516	0.20(0.07)	0.34	20.7	12.00
7	90.94	9.09	4.394	0.20(0.07)	0.34	21.7	39.10
8	91.88	9.48	4.288	0.20(0.07)	0.34	22.5	15.00
9	92.14	9.62	4.252	0.20(0.07)	0.34	22.8	43.00
10	91.11	10.22	4.109	0.20(0.07)	0.35	23.4	28.10
11	89.95	10.73	3.995	0.20(0.07)	0.35	23.8	19.00
12	87.71	11.84	3.775	0.20(0.07)	0.36	24.7	7.00
13	86.32	12.44	3.671	0.20(0.07)	0.36	25.1	20.00
14	86.00	12.57	3.649	0.20(0.07)	0.36	25.2	4.00
15	83.72	13.36	3.523	0.20(0.07)	0.37	25.4	33.00
16	78.18	15.40	3.247	0.20(0.07)	0.37	25.9	47.00

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

```

PEAK FLOW RATE (CFS) = 92.14 Tc (MIN.) = 9.62
EFFECTIVE AREA (ACRES) = 22.79 AREA-AVERAGED Fm (INCH/HR) = 0.07
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.34
TOTAL AREA (ACRES) = 25.9
LONGEST FLOWPATH FROM NODE 20.00 TO NODE 50.00 = 1738.00 FEET.
=====
END OF STUDY SUMMARY:
TOTAL AREA (ACRES) = 25.9 TC (MIN.) = 9.62
EFFECTIVE AREA (ACRES) = 22.79 AREA-AVERAGED Fm (INCH/HR) = 0.07
AREA-AVERAGED Fp (INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.345
PEAK FLOW RATE (CFS) = 92.14

```

\*\* PEAK FLOW RATE TABLE \*\*

STREAM NUMBER	Q (CFS)	Tc (MIN.)	Intensity (INCH/HR)	Fp (Fm) (INCH/HR)	Ap	Ae (ACRES)	HEADWATER NODE
1	76.55	5.96	5.593	0.20(0.07)	0.34	14.0	36.00
2	82.43	7.07	5.071	0.20(0.07)	0.34	16.8	39.00
3	88.31	8.29	4.632	0.20(0.07)	0.34	19.8	26.00
4	88.86	8.42	4.588	0.20(0.07)	0.34	20.2	30.00
5	89.39	8.57	4.544	0.20(0.07)	0.34	20.5	23.00
6	89.71	8.66	4.516	0.20(0.07)	0.34	20.7	12.00
7	90.94	9.09	4.394	0.20(0.07)	0.34	21.7	39.10
8	91.88	9.48	4.288	0.20(0.07)	0.34	22.5	15.00
9	92.14	9.62	4.252	0.20(0.07)	0.34	22.8	43.00
10	91.11	10.22	4.109	0.20(0.07)	0.35	23.4	28.10
11	89.95	10.73	3.995	0.20(0.07)	0.35	23.8	19.00
12	87.71	11.84	3.775	0.20(0.07)	0.36	24.7	7.00
13	86.32	12.44	3.671	0.20(0.07)	0.36	25.1	20.00
14	86.00	12.57	3.649	0.20(0.07)	0.36	25.2	4.00
15	83.72	13.36	3.523	0.20(0.07)	0.37	25.4	33.00
16	78.18	15.40	3.247	0.20(0.07)	0.37	25.9	47.00

END OF RATIONAL METHOD ANALYSIS

## **SECTION 3**

# HYDROLOGY MAP

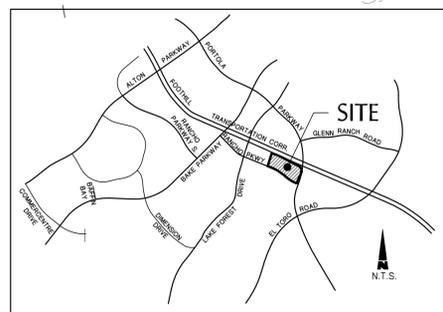


APN 104-143-  
SADDLEBACK  
CHURCH CAMP

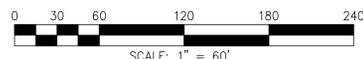
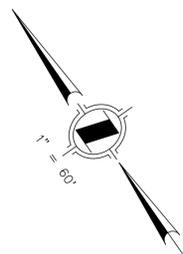
**LEGEND**

- MAJOR DRAINAGE BOUNDARY
- MINOR DRAINAGE BOUNDARY
- NODE NUMBER
- AREA DESIGNATION
- AREA ACREAGE (IN ACRES)
- $Q_{10} = 6.0\text{cfs}$   
 $Q_{15} = 8.0\text{cfs}$   
 $t = 15.0$   
C.B. #1
- $Q_{10} = 8.0\text{cfs}$   
 $Q_{15} = 10.0\text{cfs}$   
 $t = 15.0$
- PROPOSED STORM DRAIN
- SOIL GROUP

**VICINITY MAP**



APN 104-143-45  
SPORTS PARK



PREPARED FOR:  
**BAKER RANCH PROPERTIES, LLC.**  
ONE UPPER NEWPORT PLAZA, BLDG. 1  
NEWPORT BEACH, CA 92660  
(949) 251-2045

PREPARED BY:  
**HUNSAKER & ASSOCIATES**  
IRVINE, INC.  
PLANNING ■ ENGINEERING ■ SURVEYING  
Three Hughes • Irvine, CA 92618 • PH: (949) 583-1010 • FX: (949) 583-0759

**TENTATIVE TRACT MAP 17707**  
FOR CONDOMINIUM PURPOSES  
CITY OF LAKE FOREST

## **SECTION 4**

## REFERENCES

# **DRAINAGE REPORT**

**For:**

**LAKE FOREST SPORTS PARK**

CITY OF LAKE FOREST  
25550 COMMERCENTRE DRIVE SUITE 100  
COUNTY OF ORANGE, CALIFORNIA

**PREPARED BY:**

**P S O M A S**

January 29, 2010

## 1. GENERAL DISCUSSION

This report has been prepared for the Lake Forest Sports Park project to be used for the design of drainage facilities for the rough grading. The site is located west of Portola Parkway and south of the State Highway 241 in the City of Lake Forest, Orange County, California.

The purpose of this report is to provide hydrologic and basin calculations for the design of the storm drain facilities around the proposed Sports Park and the relocation of existing facilities currently located on the site. The site is bounded on the north by a commercial site south of State Highway 241, on the east by Portola Parkway and a commercial development, south of the site by Glass Creek and on the west by an industrial development. The site is currently undeveloped and existing runoff drains to Glass Creek which discharges into Aliso Creek.

On-site storm drain improvements include the construction of desilting basins that will discharge into existing 60-inch laterals, Facility No. J01P06, west of the project and Aliso Creek confluencing with existing drainage, maintaining existing drainage patterns.

The primary objectives of this report are as follows:

1. Delineate the drainage area tributary to each proposed drainage inlet and concentration points.
2. Perform hydrologic analysis using the Orange County Rational Method to determine the design flows for sizing the proposed drainage facilities.
3. Provide calculations to size the proposed desilting basins that will detain peak runoff and provide water quality protection.

## HYDROLOGY

Hydrologic calculations for the design of the storm drain facilities associated with the Lake Forest Sports Park were performed in accordance with the guidelines specified in the Orange County Hydrology Manual. The hydrology for the project was performed for a 25-year frequency storm.

This hydrology report was prepared on the assertion that the existing downstream storm drain improvements are adequate to accept drainage from this project.

## **METHODOLOGY**

The Rational Method, as described in the Orange County Hydrology Manual, was used to calculate the on-site existing and proposed peak storm runoff. Computations of these hydrology calculations were provided through the "RATOC" hydrology computer program by Advanced Engineering. The hydrology calculations are based on Soil Group D. Calculations for the existing condition were performed using Barren and Open Brush Land Use. The proposed condition calculations were performed using Barren and Commercial Land Use. Even though the site's ultimate land usage will be for a park, the calculations are based on the assumption that synthetic turf will be used on the fields resulting in 100% runoff. The final report will be revised with the correct land use factor when the City of Lake Forest provides the land cover material approved for usage on the fields.

The design discharges were calculated by modeling the project site into tributary subareas.

The attached hydrology maps depict the accumulated runoff for Subarea "A."

## **DESILTING BASINS**

The storm water quality for the Lake Forest Sports Park will be handled through the use of earthen swales detention basins. The basins are sized using the storm water quality design flow (SQDF) according to the Orange County Drainage Area Master Plan (DAMP 2003). Detailed discussion of the post construction water quality measures to be implemented by this project can be found in the project Water Quality Management Plan (WQMP).

## **SUMMARY**

The existing hydrology was calculated for an area of approximately 128.18 acres with peak flow of 145.91 CFS. The proposed hydrology was calculated for 127.9 acres and has a peak flow of 242.31 CFS. Desilting basins/storm water quality devices will provide treatment to the runoff before draining from the site. The proposed drainage will be similar to the existing condition: the developed site will have a net increase in peak flow of 46.4 CFS for the 25-year peak runoff leaving the project site into Aliso Creek.

**25-Year**

**Proposed Condition– Drainage Area “A”**

\*\*\*\*\*

RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE  
(Reference: 1986 ORANGE COUNTY HYDROLOGY CRITERION)  
(c) Copyright 1983-2002 Advanced Engineering Software (aes)  
Ver. 8.0 Release Date: 01/01/2002 License ID 1286

Analysis prepared by:

Psomas  
3187 Red Hill Ave., Ste. 250  
Costa Mesa, CA 92626

-----  
FILE NAME: 2LAKHYPR.DAT  
TIME/DATE OF STUDY: 15:56 01/28/2010  
=====

=====

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

=====

---\*TIME-OF-CONCENTRATION MODEL\*---

USER SPECIFIED STORM EVENT(YEAR) = 25.00  
SPECIFIED MINIMUM PIPE SIZE(INCH) = 12.00  
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95  
\*DATA BANK RAINFALL USED\*  
\*ANTECEDENT MOISTURE CONDITION (AMC) II ASSUMED FOR RATIONAL METHOD\*

\*USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL\*

NO.	HALF-CROWN TO STREET-CROSSFALL:		STREET-CROSSFALL:		CURB HEIGHT (FT)	GUTTER-GEOMETRIES:			MANNING FACTOR (n)
	WIDTH (FT)	CROSSFALL (FT)	IN-SIDE	OUT-/PARK-SIDE/ WAY		WIDTH (FT)	LIP (FT)	HIKE (FT)	
1	30.0	20.0	0.018	0.018/0.020	0.50	2.00	0.0313	0.167	0.0150

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.50 FEET  
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
  2. (Depth)\*(Velocity) Constraint = 7.0 (FT\*FT/S)
- \*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.\*  
\*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

\*\*\*\*\*

FLOW PROCESS FROM NODE 1.00 TO NODE 2.00 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<  
>>USE TIME-OF-CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA<<

=====

INITIAL SUBAREA FLOW-LENGTH(FEET) = 300.00  
ELEVATION DATA: UPSTREAM(FEET) = 796.00 DOWNSTREAM(FEET) = 789.30

Tc = K\*[(LENGTH\*\* 3.00)/(ELEVATION CHANGE)]\*\*0.20  
SUBAREA ANALYSIS USED MINIMUM Tc(MIN.) = 6.367  
\* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 4.207

SUBAREA Tc AND LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/	SCS SOIL	AREA	Fp	Ap	SCS	Tc
-------------------	----------	------	----	----	-----	----

LAND USE                    GROUP    (ACRES)    (INCH/HR)    (DECIMAL)    CN    (MIN.)  
 COMMERCIAL                    D            1.78        0.20        0.10        75        6.37  
 SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.10  
 SUBAREA RUNOFF(CFS) = 6.71  
 TOTAL AREA(ACRES) = 1.78    PEAK FLOW RATE(CFS) = 6.71

\*\*\*\*\*  
 FLOW PROCESS FROM NODE            2.00 TO NODE            3.00 IS CODE = 56  
 -----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<<  
 >>>>TRAVELTIME THRU SUBAREA<<<<<<

=====  
 ELEVATION DATA: UPSTREAM(FEET) = 789.30    DOWNSTREAM(FEET) = 776.50  
 CHANNEL LENGTH THRU SUBAREA(FEET) = 912.00    CHANNEL SLOPE = 0.0140  
 GIVEN CHANNEL BASE(FEET) = 10.00    CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000    MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 0.86  
 GIVEN CHANNEL BASE(FEET) = 10.00    CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000    MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 0.84  
 \* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.534

SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	$F_p$ (INCH/HR)	$A_p$ (DECIMAL)	SCS CN
COMMERCIAL	D	9.97	0.20	0.10	75

SUBAREA AVERAGE PERVIOUS LOSS RATE,  $F_p$ (INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION,  $A_p$  = 0.10  
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 22.58  
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 6.25  
 AVERAGE FLOW DEPTH(FEET) = 0.34    TRAVEL TIME(MIN.) = 2.43  
 $T_c$ (MIN.) = 8.80  
 SUBAREA AREA(ACRES) = 9.97    SUBAREA RUNOFF(CFS) = 31.53  
 EFFECTIVE AREA(ACRES) = 11.75    AREA-AVERAGED  $F_m$ (INCH/HR) = 0.02  
 AREA-AVERAGED  $F_p$ (INCH/HR) = 0.20    AREA-AVERAGED  $A_p$  = 0.10  
 TOTAL AREA(ACRES) = 11.75    PEAK FLOW RATE(CFS) = 37.16  
 GIVEN CHANNEL BASE(FEET) = 10.00    CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000    MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 0.95

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.45    FLOW VELOCITY(FEET/SEC.) = 7.49  
 LONGEST FLOWPATH FROM NODE            1.00 TO NODE            3.00 = 1212.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE            3.00 TO NODE            4.00 IS CODE = 56  
 -----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<<  
 >>>>TRAVELTIME THRU SUBAREA<<<<<<

=====  
 ELEVATION DATA: UPSTREAM(FEET) = 776.50    DOWNSTREAM(FEET) = 767.50  
 CHANNEL LENGTH THRU SUBAREA(FEET) = 810.00    CHANNEL SLOPE = 0.0111  
 GIVEN CHANNEL BASE(FEET) = 10.00    CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000    MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.08  
 GIVEN CHANNEL BASE(FEET) = 10.00    CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000    MANNING'S FACTOR = 0.013

\*ESTIMATED CHANNEL HEIGHT(FEET) = 1.07  
 \* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.169  
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	7.51	0.20	0.10	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10  
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 47.81  
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 7.57  
 AVERAGE FLOW DEPTH(FEET) = 0.57 TRAVEL TIME(MIN.) = 1.78  
 Tc(MIN.) = 10.58  
 SUBAREA AREA(ACRES) = 7.51 SUBAREA RUNOFF(CFS) = 21.28  
 EFFECTIVE AREA(ACRES) = 19.26 AREA-AVERAGED Fm(INCH/HR) = 0.02  
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10  
 TOTAL AREA(ACRES) = 19.26 PEAK FLOW RATE(CFS) = 54.58  
 GIVEN CHANNEL BASE(FEET) = 10.00 CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000 MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.11

END OF SUBAREA CHANNEL FLOW HYDRAULICS:  
 DEPTH(FEET) = 0.61 FLOW VELOCITY(FEET/SEC.) = 8.01  
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 4.00 = 2022.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 4.00 TO NODE 4.00 IS CODE = 81  
 -----

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

MAINLINE Tc(MIN) = 10.58  
 \* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.169  
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	7.37	0.20	0.10	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10  
 SUBAREA AREA(ACRES) = 7.37 SUBAREA RUNOFF(CFS) = 20.89  
 EFFECTIVE AREA(ACRES) = 26.63 AREA-AVERAGED Fm(INCH/HR) = 0.02  
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10  
 TOTAL AREA(ACRES) = 26.63 PEAK FLOW RATE(CFS) = 75.47

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 4.00 TO NODE 5.00 IS CODE = 56  
 -----

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 767.50 DOWNSTREAM(FEET) = 756.00  
 CHANNEL LENGTH THRU SUBAREA(FEET) = 250.00 CHANNEL SLOPE = 0.0460  
 GIVEN CHANNEL BASE(FEET) = 10.00 CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000 MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.00  
 GIVEN CHANNEL BASE(FEET) = 10.00 CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000 MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.00  
 \* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.124

SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	2.61	0.20	0.10	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10  
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) = 79.11  
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) = 14.36  
 AVERAGE FLOW DEPTH(FEET) = 0.50 TRAVEL TIME(MIN.) = 0.29  
 Tc(MIN.) = 10.87  
 SUBAREA AREA(ACRES) = 2.61 SUBAREA RUNOFF(CFS) = 7.29  
 EFFECTIVE AREA(ACRES) = 29.24 AREA-AVERAGED Fm(INCH/HR) = 0.02  
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10  
 TOTAL AREA(ACRES) = 29.24 PEAK FLOW RATE(CFS) = 81.67  
 GIVEN CHANNEL BASE(FEET) = 10.00 CHANNEL FREEBOARD(FEET) = 0.5  
 "Z" FACTOR = 2.000 MANNING'S FACTOR = 0.013  
 \*ESTIMATED CHANNEL HEIGHT(FEET) = 1.01

END OF SUBAREA CHANNEL FLOW HYDRAULICS:

DEPTH(FEET) = 0.51 FLOW VELOCITY(FEET/SEC.) = 14.59  
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 5.00 = 2272.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 5.00 TO NODE 5.00 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

MAINLINE Tc(MIN) = 10.87  
 \* 25 YEAR RAINFALL INTENSITY(INCH/HR) = 3.124  
 SUBAREA LOSS RATE DATA(AMC II):

DEVELOPMENT TYPE/ LAND USE	SCS SOIL GROUP	AREA (ACRES)	Fp (INCH/HR)	Ap (DECIMAL)	SCS CN
COMMERCIAL	D	5.93	0.20	0.10	75

SUBAREA AVERAGE PERVIOUS LOSS RATE, Fp(INCH/HR) = 0.20  
 SUBAREA AVERAGE PERVIOUS AREA FRACTION, Ap = 0.10  
 SUBAREA AREA(ACRES) = 5.93 SUBAREA RUNOFF(CFS) = 16.56  
 EFFECTIVE AREA(ACRES) = 35.17 AREA-AVERAGED Fm(INCH/HR) = 0.02  
 AREA-AVERAGED Fp(INCH/HR) = 0.20 AREA-AVERAGED Ap = 0.10  
 TOTAL AREA(ACRES) = 35.17 PEAK FLOW RATE(CFS) = 98.24

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 5.00 TO NODE 6.00 IS CODE = 31

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<

>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 756.00 DOWNSTREAM(FEET) = 735.74  
 FLOW LENGTH(FEET) = 130.00 MANNING'S N = 0.013  
 DEPTH OF FLOW IN 27.0 INCH PIPE IS 18.7 INCHES  
 PIPE-FLOW VELOCITY(FEET/SEC.) = 33.47  
 ESTIMATED PIPE DIAMETER(INCH) = 27.00 NUMBER OF PIPES = 1  
 PIPE-FLOW(CFS) = 98.24  
 PIPE TRAVEL TIME(MIN.) = 0.06 Tc(MIN.) = 10.94  
 LONGEST FLOWPATH FROM NODE 1.00 TO NODE 6.00 = 2402.00 FEET.

\*\*\*\*\*  
 FLOW PROCESS FROM NODE 7.00 TO NODE 7.00 IS CODE = 81

Job No. 2LAK020700 Sheet 1 of     

Prepared by Steve Baine Date 1/28/10

Project Name Lake Forest Sports Park

Reviewed by                      Date             

Title Preliminary Drainage Study  
Detention Basin Calculations

FWA No.                     

PRELIMINARY DRAINAGE STUDY

DETENTION BASIN CALCULATIONS

Baker Parcel & Rancho Parkway

Area

40.3 Ac

Existing Condition:

$Q_{25} = 73.5 \text{ cfs}$

$T_c = 17.6 \text{ min}$

35.2 Ac

Proposed Condition:

$Q_{25} = 98.2 \text{ cfs}$

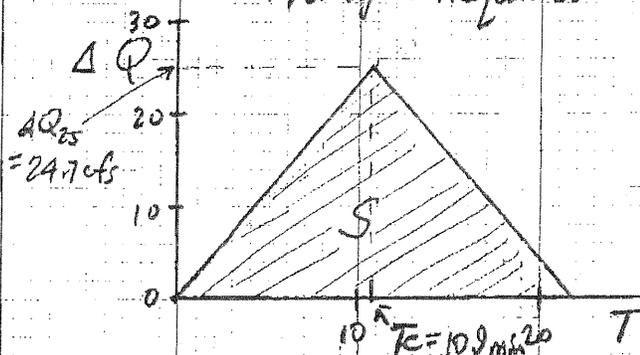
$T_c = 10.9 \text{ min}$

Storage Required:  $\Delta Q_{25} = 98.2 - 73.5 = 24.7 \text{ cfs}$

$S = \Delta Q_{25} \times T_c$

$= 24.7 \frac{\text{ft}^3}{\text{s}} \times 10.9 \text{ min} \times \frac{60 \text{ sec}}{1 \text{ min}}$

$S = 16,154 \text{ CF} = 0.37 \text{ Ac-ft.}$



BAKER & RADOS PARCELS S/O RANCHO PKWY.

Area

12.3 Ac

Existing Condition:

$Q_{25} = 29.5 \text{ cfs}, T_c = 12.6 \text{ min.}$

34.0 Ac

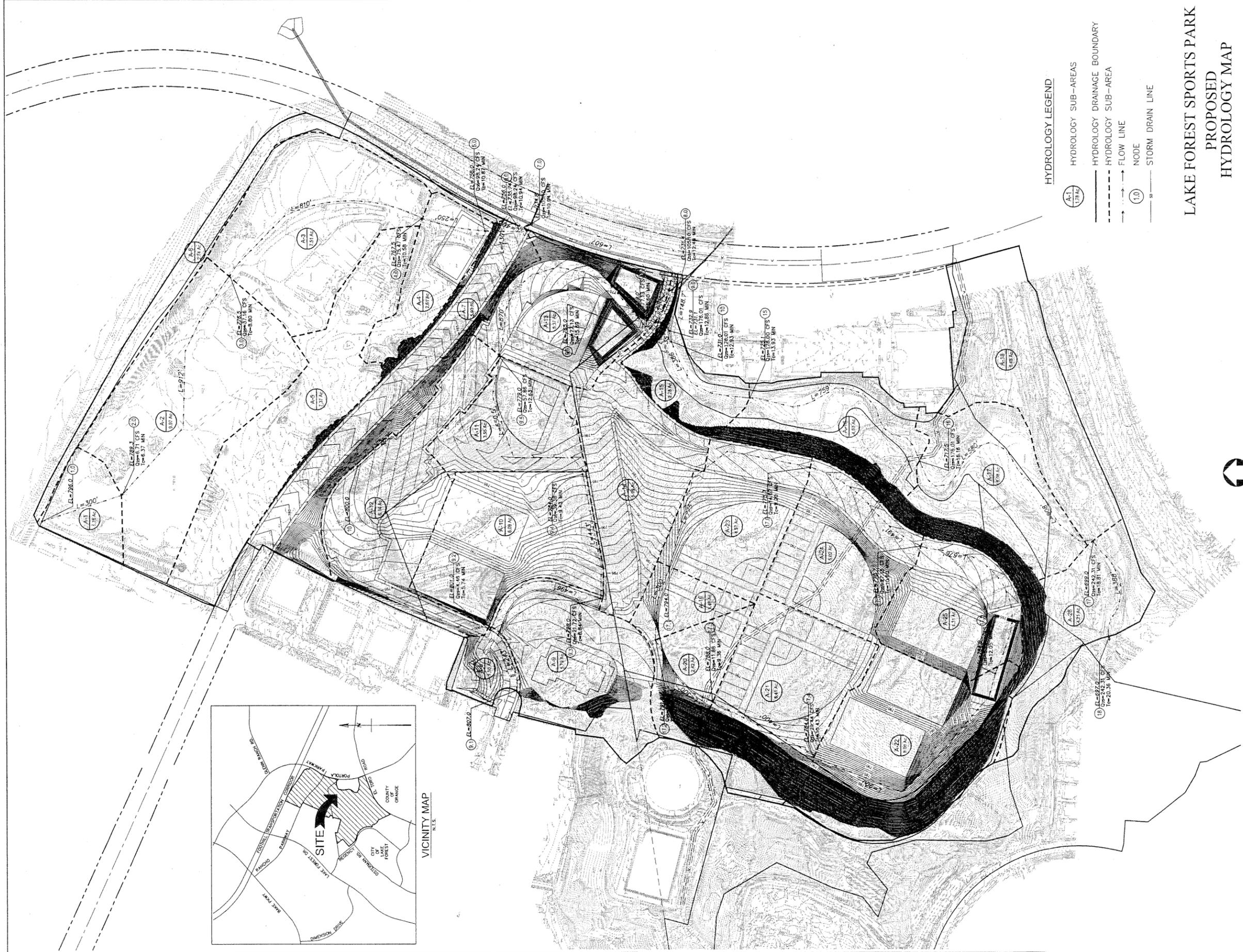
Proposed Condition:

$Q_{25} = 77.1 \text{ cfs}, T_c = 15.6 \text{ min}$

Storage Required:

$\Delta Q_{25} = 77.1 - 29.5 = 47.6 \text{ cfs}$

$S = 44,554 \text{ CF} = 1.02 \text{ Ac-ft}$



**HYDROLOGY LEGEND**

	HYDROLOGY SUB-AREAS
	HYDROLOGY DRAINAGE BOUNDARY
	HYDROLOGY SUB-AREA
	FLOW LINE
	NODE
	STORM DRAIN LINE

**LAKE FOREST SPORTS PARK  
PROPOSED  
HYDROLOGY MAP**

**P S O M A S**

DATE: 1/29/10      REVISED ON:  
 JOB No.: 2LAK020700      SHEET 1 OF 1

THE CITY OF LAKE FOREST  
 Public Works Department

W:\2LAK0207\PROJ\2506\2506.dwg\Printer\_Preview\_LakeForest\_Hydrology\_Map.dwg



**HYDROLOGY LEGEND**

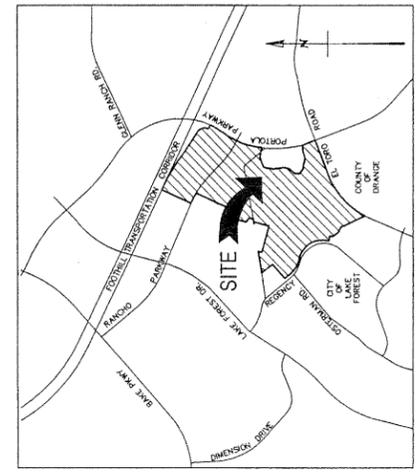
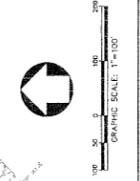
- (A-1) HYDROLOGY SUB-AREAS
- HYDROLOGY DRAINAGE BOUNDARY
- - - - HYDROLOGY SUB-AREA
- - - -> FLOW LINE
- (10) NODE
- STORM DRAIN LINE

**LAKE FOREST SPORTS PARK  
EXISTING  
HYDROLOGY MAP**

**P S O M A S**

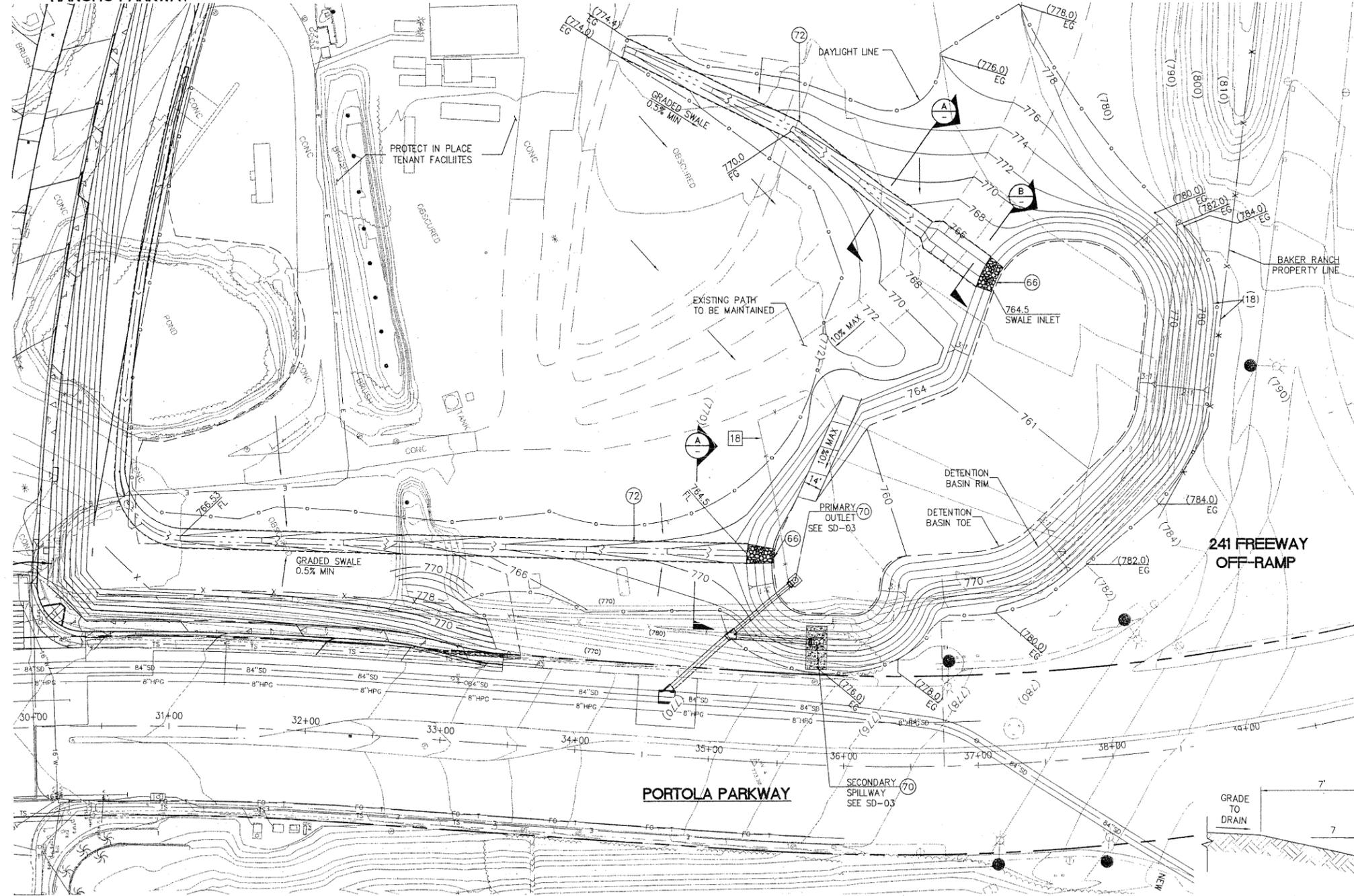
DATE: 1/29/10 REVISION: ON:  
JOB No.: 2LAKO20700 SHEET 1 OF 1

THE CITY OF LAKE FOREST  
Public Works Department



VICINITY MAP  
N.T.S.

**RANCHO PARKWAY**



**CONSTRUCTION NOTES:**

ALL OBJECTS TO BE REMOVED WITHIN PROJECT LIMITS UNLESS OTHERWISE NOTED.

- CONSTRUCT
- REMOVE
- RELOCATE EXISTING
- ADJUST EXISTING TO GRADE

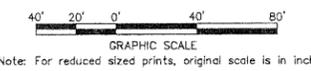
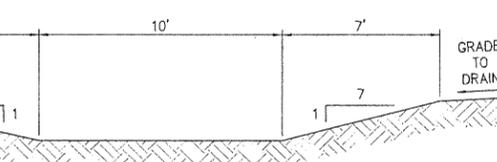
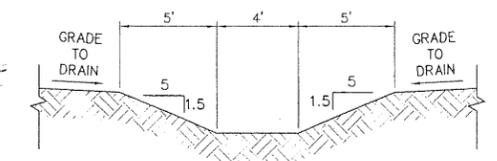
- 18. CHAIN LINK FENCE
- 66. RIP RAP, 1/4 TON CLASS
- 70. INLET TYPE V PER OCRMD STD PLAN 1305, PIPE SIZE PER PLAN AND PROFILE
- 72. GRADED SWALE, SLOPE PER PLAN (SEE TYP SEC FOR DETAILS)

**HATCH / LINE LEGEND**

- E— EXISTING ELECTRICAL
- FO— EXISTING FIBER OPTIC
- SD— EXISTING STORM DRAIN
- SS— EXISTING SANITARY SEWER
- G— EXISTING GAS
- W— EXISTING WATER
- T— EXISTING TELECOMMUNICATION

**GENERAL NOTES**

- SWALE NOTES:**
- THE CONTRACTOR SHALL COORDINATE THE LOCATION OF ONE 24" WIDE AREA FOR PASSENGER VEHICLES TO CROSS OVER THE SWALE CLOSEST TO PORTOLA WITH THE ENGINEER AND PROPERTY OWNER PRIOR TO GRADING.
  - THE SWALE LOCATION MAY MOVE SLIGHTLY WEST TO STAY AWAY FROM TENANTS ALONG PORTOLA.
  - UNLESS OTHERWISE DIRECTED, THE EXISTING TRAVEL PATH PARALLEL TO PORTOLA IS TO REMAIN IN USE AND THE NEW SWALE IS TO BE LOCATED WEST OF THAT.



Underground Service Alert of Southern California  
Call: TOLL FREE 1-800-227-2600  
TWO WORKING DAYS BEFORE YOU DIG

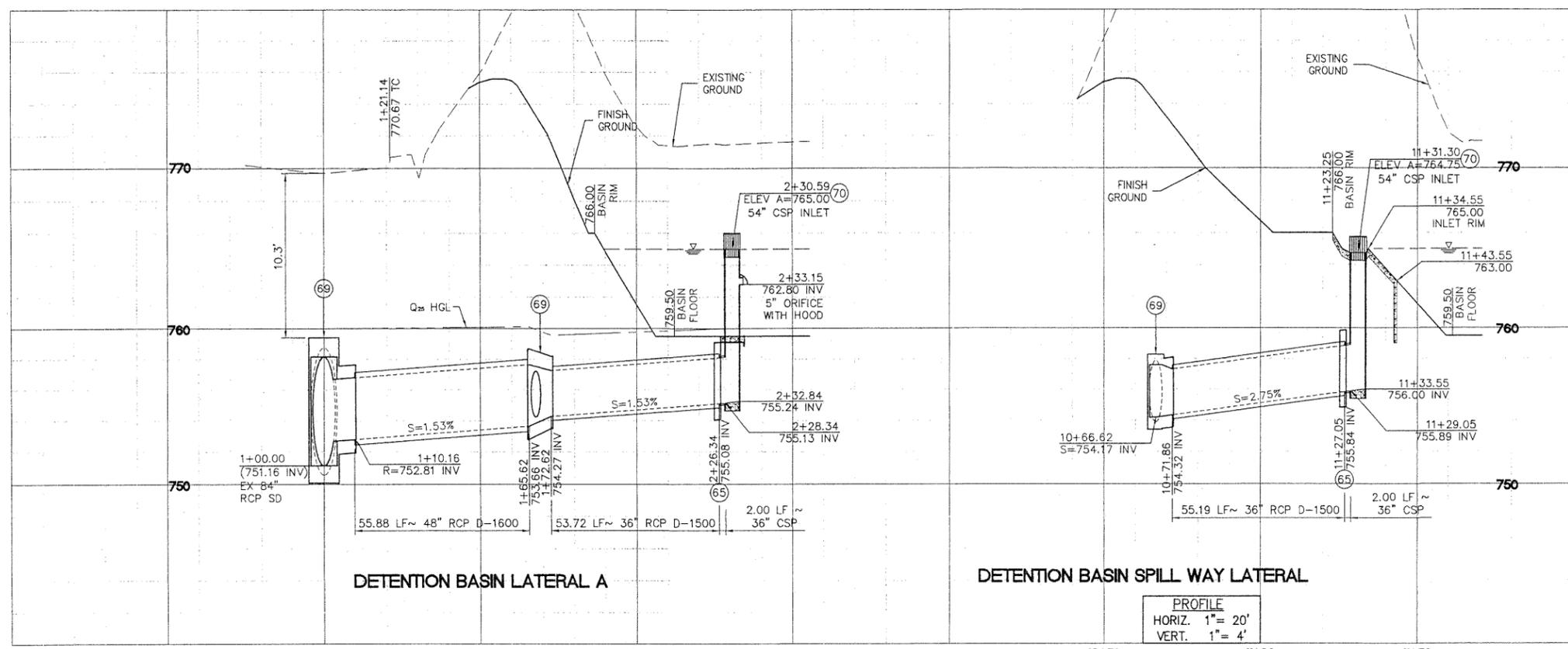
NO.	DATE	REVISIONS	APP.	DATE

PLANS PREPARED BY:  
**PSOMAS**  
3 Hutton Centre Drive, Suite 200  
Santo Ana, CA 92707  
(714) 751-7373 Fax (714) 545-8883  
Dec. 20, 2011  
ANISSA VOYATZES, P.E., RCE 57710



STREET IMPROVEMENT PLANS  
**RANCHO PARKWAY IMPROVEMENT PROJECT**  
BAKER RANCH DETENTION BASIN  
**THE CITY OF LAKE FOREST**  
Public Works Department

**DB-01**  
PROJECT NO. PW 2009.06  
SHEET **18**  
OF **46**



**LINE / CURVE TABLE**

#	DELTA/BRG	RADIUS	LENGTH	TANGENT
H	N 14°20'15" W	-	55.88'	-
I	N 14°20'15" W	-	53.72'	-
J	N 30°39'45" E	-	53.19'	-

**NOTE TO CONTRACTOR:**  
 LOCATION OF EXISTING UTILITIES ARE APPROXIMATE AND DEPTH IS UNKNOWN. CONTRACTOR SHALL VERIFY THE LOCATION AND DEPTH OF ALL UTILITIES PRIOR TO THE START OF EXCAVATION. CONTRACTOR SHALL TAKE CARE DURING EXCAVATION AND PROTECT IN PLACE ALL UTILITIES ENCOUNTERED. DAMAGED UTILITY FACILITIES SHALL BE REPAIRED AT NO ADDITIONAL COST.

**LINE LEGEND**

- E- EXISTING ELECTRICAL
- FO- EXISTING FIBER OPTIC
- G- EXISTING GAS
- SD- EXISTING STORM DRAIN
- S- EXISTING STREET LIGHT CONDUIT
- SS- EXISTING SANITARY SEWER
- T- EXISTING TELECOMMUNICATION
- W- EXISTING WATER
- ⊙ POT HOLE LOCATION

**CONSTRUCTION NOTES:**

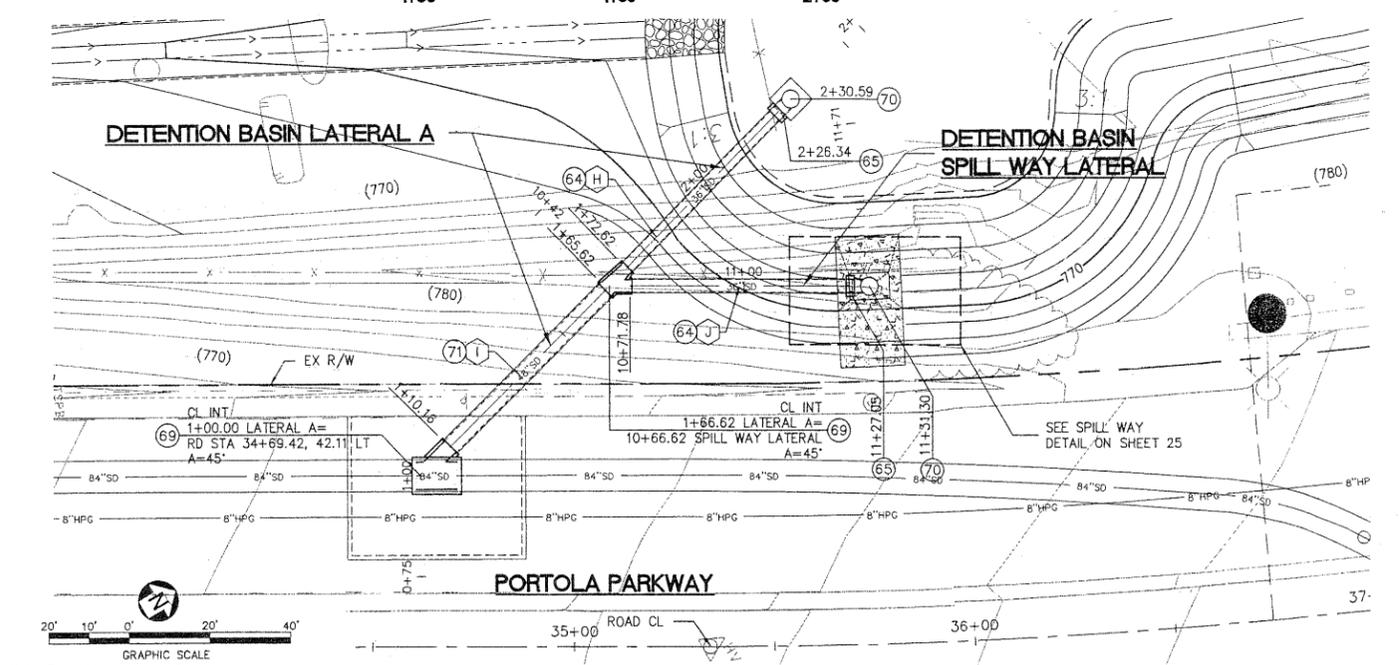
ALL OBJECTS WITHIN PROJECT LIMITS TO BE REMOVED UNLESS OTHERWISE NOTED.

- CONSTRUCT
- REMOVE
- RELOCATE EXISTING
- ADJUST EXISTING TO GRADE

64. 36" RCP, D-LOAD PER PROFILE
65. CONCRETE COLLAR PER OCRDMD STD PLAN 1317
69. JUNCTION STRUCTURE TYPE III, WITH NO MANHOLE, PER OCRDMD STD PLAN 1312
70. INLET TYPE V PER OCRDMD STD PLAN 1305, PIPE SIZE PER PLAN AND PROFILE
71. 48" RCP, D-LOAD PER PROFILE.

**GENERAL NOTES:**

1. PIPE BEDDING SHALL CONFORM TO DETAIL ON SHEET 21.
2. CONTRACTOR SHALL VERIFY ALL CONTROLLING FIELD DIMENSIONS BEFORE ORDERING OR FABRICATING ANY MATERIALS.
3. CONTRACTOR SHALL VERIFY BY SUBSURFACE INVESTIGATION EXACT SIZE AND LOCATION (HORIZONTAL AND VERTICAL) OF EXISTING CROSSING AND JOINING UTILITIES PRIOR TO CONSTRUCTION AND NOTIFY THE ENGINEER 72 HOURS PRIOR TO EXCAVATION.



**Underground Service Alert**  
 of Southern California  
 Call: TOLL FREE  
 1-800-227-2600  
 TWO WORKING DAYS BEFORE YOU DIG

NO.	DATE	REVISIONS	APP.	DATE

PLANS PREPARED BY:  
**PSOMAS**  
 3 Hutton Centre Drive, Suite 200  
 Santa Ana, CA 92707  
 (714) 751-7373 Fax (714) 545-8883  
 Dec. 20, 2011

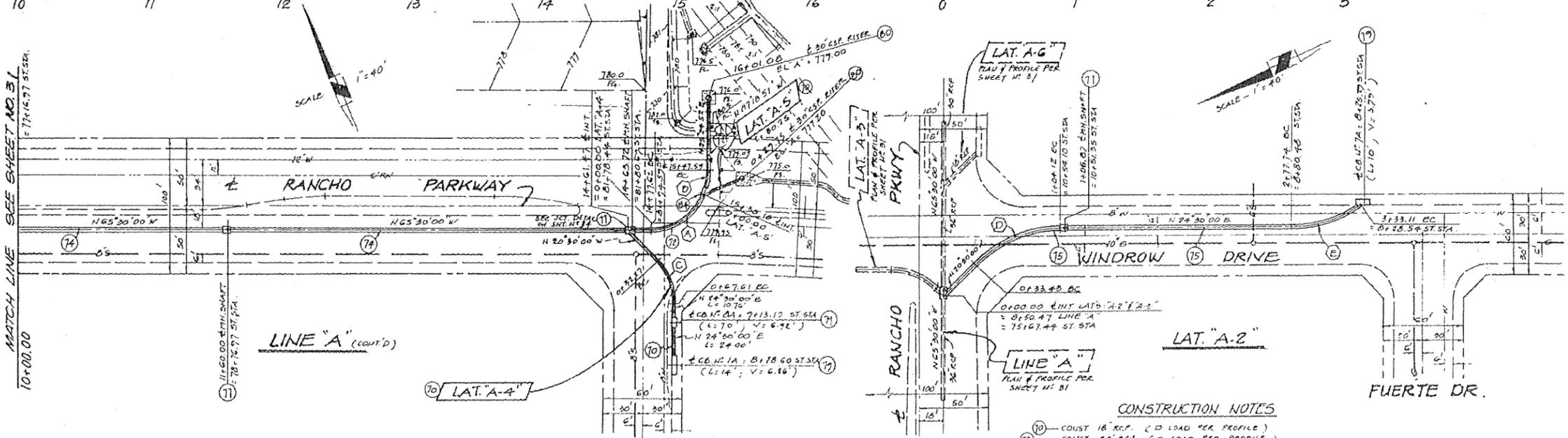
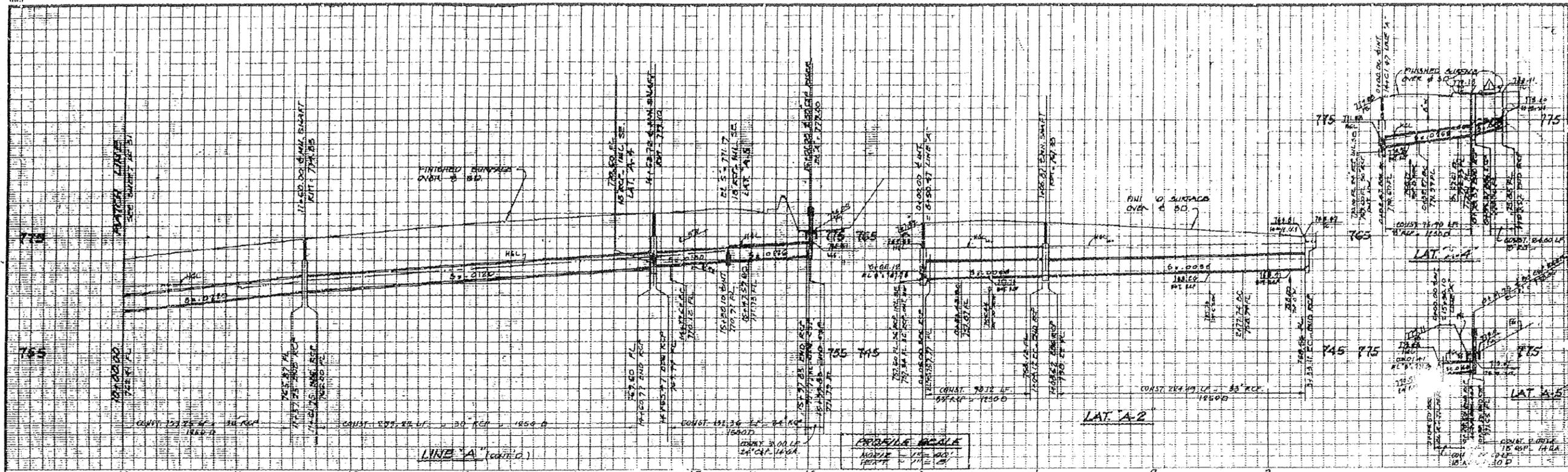
PROFESSIONAL ENGINEER  
 ANISSA VOYATZES  
 No. 57710  
 Exp. 12/31/13  
 CIVIL  
 STATE OF CALIFORNIA

STREET IMPROVEMENT PLANS  
**RANCHO PARKWAY IMPROVEMENT PROJECT**  
 STORM DRAIN - DETENTION BASIN AND SPILLWAY LATERALS

SD-03  
 PROJECT NO. PW 2009.06  
 SHEET 23 OF 46

THE CITY OF LAKE FOREST  
 Public Works Department

DWG Name: M:\2\AK020600\Public\_Works\Sheets\SD-03\_TO BE REVISED.dwg Plotted by: jonathon.levitus on Dec 23, 2011 17:58:35



HYDRAULIC DATA

LINE	STATION TO STATION	Q	B <sub>0</sub>	B <sub>1</sub>	D <sub>10</sub>	V <sub>1</sub>	V <sub>2</sub>	D <sub>2</sub>	V <sub>2</sub>
LINE A	10+00.00 - 14+57.25	135.9	0.020	0.017	30	1.8	1.7	2.03	8.4
	14+57.25 - 14+50.77	135.9	0.020	0.017	30	1.67	1.6	2.03	8.4
	14+50.77 - 15+30.10	135.9	0.020	0.016	24	1.40	1.2	1.72	8.1
	15+30.10 - 15+77.05	135.9	0.020	0.019	24	1.15	0.5	1.44	6.6
LAT. A-2	0+00.00 - 1+04.12	135.9	0.020	0.019	35	1.75	0.8	1.50	6.5
	1+04.12 - 3+33.11	135.9	0.020	0.019	35	1.75	0.8	1.50	6.5
LAT. A-4	0+00.00 - 0+28.57	12.7	0.025	0.016	18	1.76	1.0	1.84	7.6
	0+28.57 - 1+09.57	12.7	0.025	0.016	18	1.76	1.0	1.84	7.6
LAT. A-5	0+00.00 - 0+28.50	12.7	0.025	0.016	18	1.76	1.0	1.84	7.6

Q = 10 YR.    C<sub>0</sub> = 100 YR.  
C<sub>1</sub> = 25 YR.    I<sub>0</sub> = 1.0

HERMANA CIR. R.C.P. CURVE DATA

LINE	REF.	Δ	R	L	T
A	LINE A	66°48'51"	45'	52.45	27.68
B		22°16'17"	45'	17.47	8.85
C		45°00'00"	45'	35.84	18.64
D	LAT. A-2	45°00'00"	70'	70.69	37.20
E		35°14'51"	70'	55.37	28.57

- CONSTRUCTION NOTES
- 10 - CONST. 18" R.C.P. (C.D. LOAD PER PROFILE)
  - 11 - CONST. 24" R.C.P. (C.D. LOAD PER PROFILE)
  - 12 - CONST. 30" R.C.P. (C.D. LOAD PER PROFILE)
  - 13 - CONST. 36" R.C.P. (C.D. LOAD PER PROFILE)
  - 14 - CONST. JUNCTION STRUCTURE TYPE "A" PER OCEMA STD. NO. 310
  - 15 - CONST. INLET TYPE "A" PER OCEMA STD. NO. 1301
  - 16 - CONST. INLET TYPE "E" (C.D. PER PLAN) PER OCEMA STD. NO. 1302
  - 17 - CONST. DROP INLET STRUCTURE PER DETAIL ON SHEET NO. 54
  - 18 - CONST. JUNCTION STRUCTURE TYPE "B" PER OCEMA STD. NO. 1315



**Robert Bein, William Frost & Associates**  
 PROFESSIONAL ENGINEERS, PLANNERS & SURVEYORS  
 28 Kallenbaugh  
 5 ROBERT KALLENBAUGH R.C.E. 27997  
 4-A-89  
 DATE

DATE	BY	DESCRIPTION	APP'D. DATE
8-29-90	OK	REVISED TO ELEV. FOR C.D. (SEE PLAN LAT. A-4)	

APPROVED  
 CITY ENGINEER  
 R.C.E. NO.  
 DATE

PLAN AND PROFILE FOR THE IMPROVEMENT OF STORM DRAIN  
**LINE "A"**  
 FROM STA. 10+00.00 TO STA. 16+01.08  
**LAT. "A-2"**  
 FROM STA. 0+00.00 TO STA. 3+33.11

SHEET  
 32  
 OF  
 38

TR-IMP. 13932